

LBNF Hadron Absorber: Plan for Final Design, Procurement, and Assembly

Preliminary Design Review

Vladimir Sidorov and Abhishek Deshpande

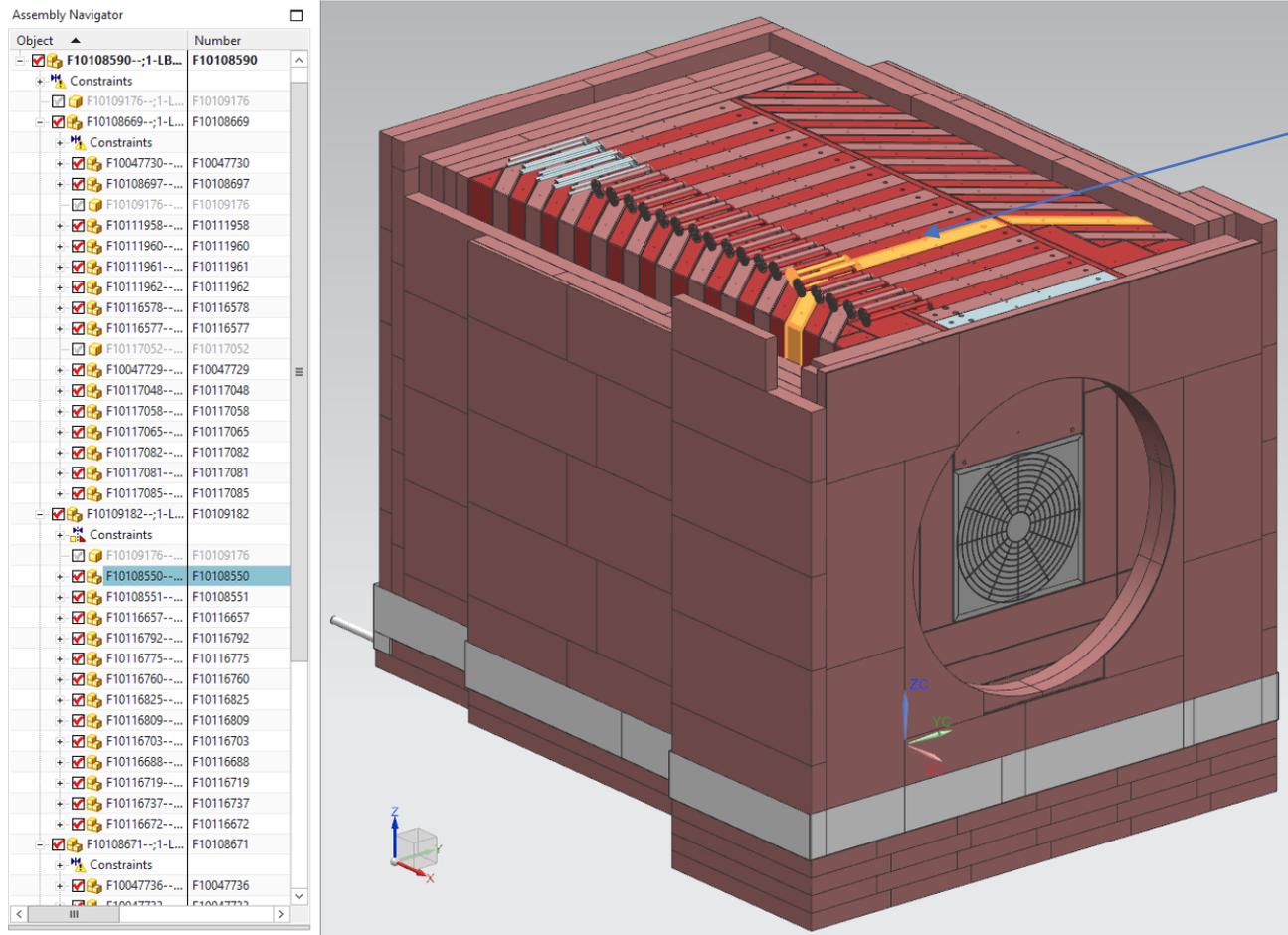
June 26 , 2020



Absorber final design planning .

All Absorber components models and drawings are located in the Team center.

Before the absorber final design beginning the energy deposition in the Absorber Complex MARS calculations, the core blocks and steel shielding thermo and stress analyses, the absorber-decay pipe, the absorber-water cooling system, the absorber- air cooling system, the absorber –Hadron monitor interface have to be completed.

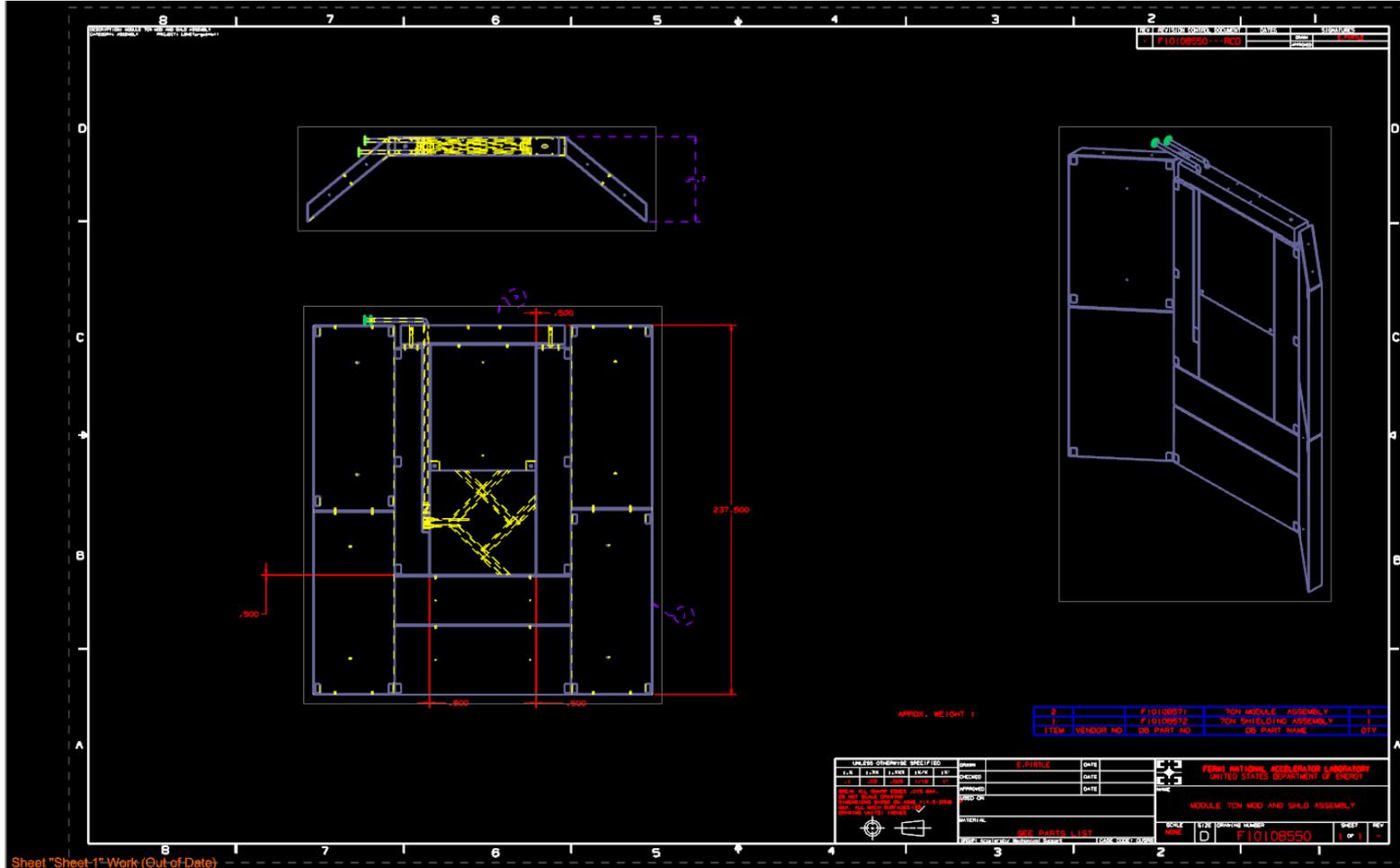


Absorber core
blocks and
shielding assembly

Highlighted assembly drawing F10108550

Assembly Navigator

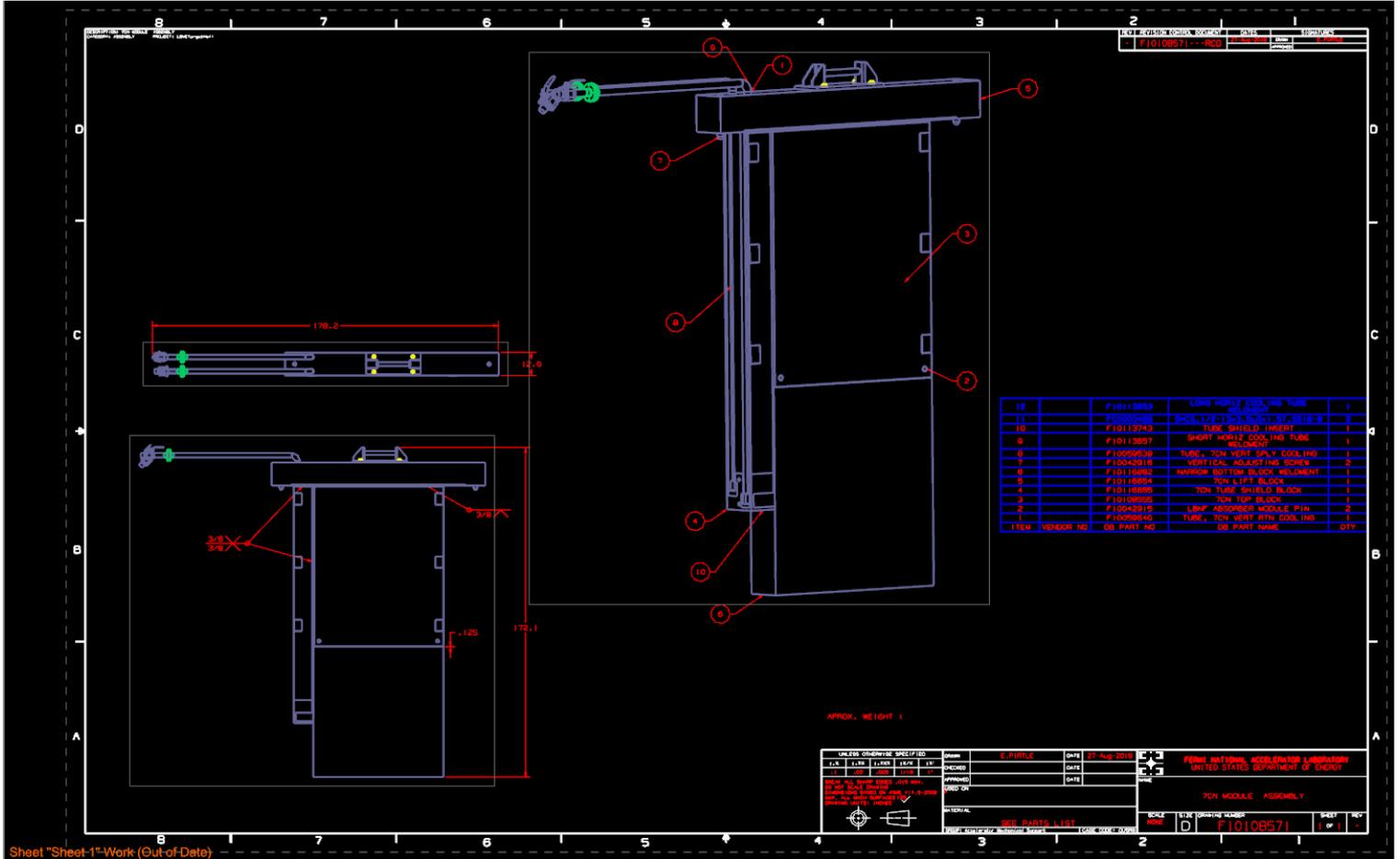
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[-] Constraints	
[-] F10108572--:...	F10108572
[-] Constraints	
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[x] F101166...	F10116656
[x] F101165...	F10116572
[x] F101162...	F10116239
[x] F101162...	F10116231
[x] F101162...	F10116229
[x] F101126...	F10112687
[x] F101086...	F10108611
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[x] F101136...	F10113657
[x] F101136...	F10113653
[x] F101085...	F10108555
[x] F100595...	F10059540
[x] F100595...	F10059539
[x] F100429...	F10042916
[x] F100429...	F10042915



Module – Core block assembly drawing

Assembly Navigator

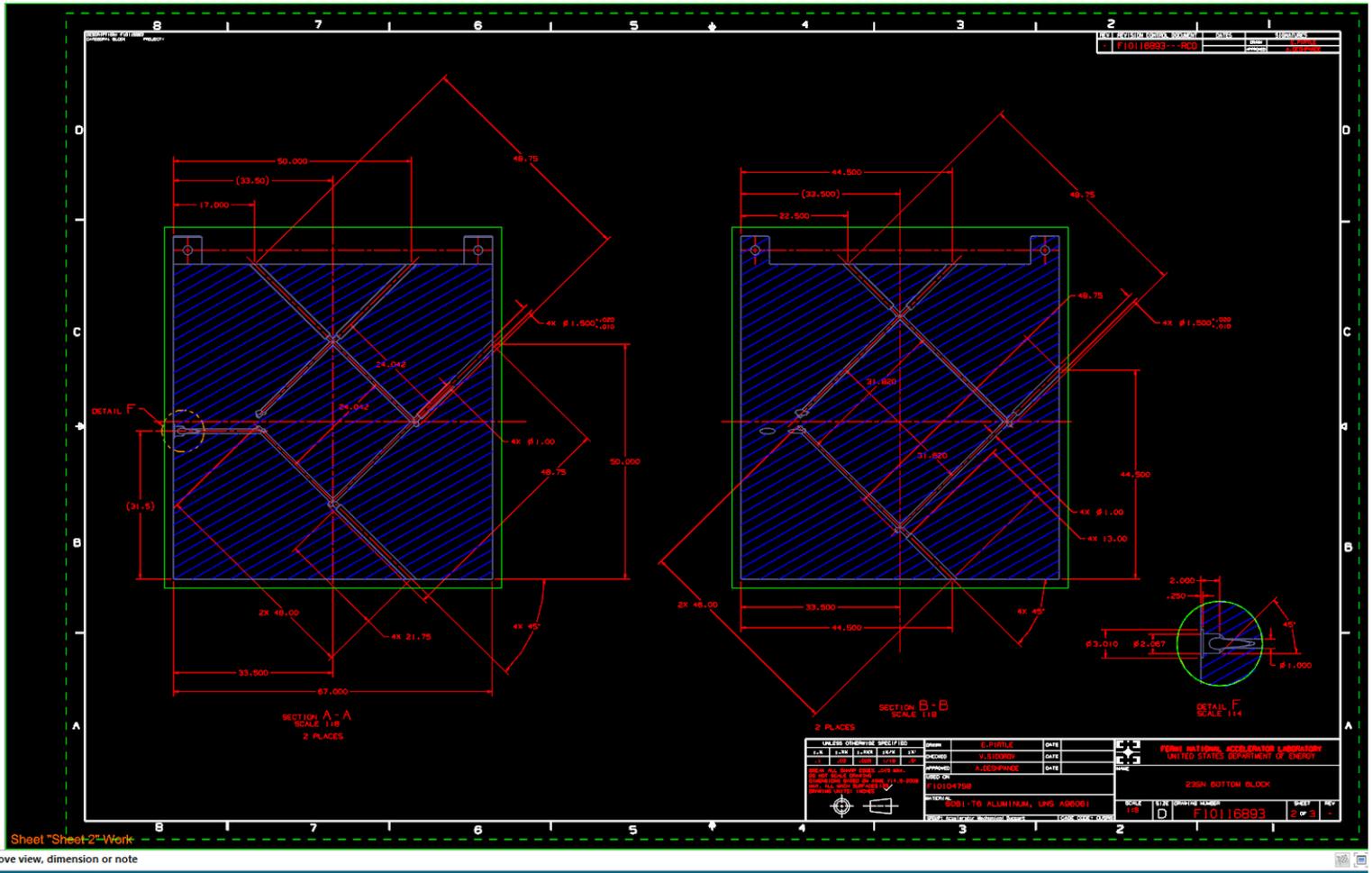
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Core block drawing

Assembly Navigator

Object	Number
Sections	
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Sheet "Sheet 2" Work
objects and use MB3, or double-click, or press-drag to move view, dimension or note

Shielding plate drawing

Part Navigator

Name	Up to Date
[-] Drawing	
[-] Sheet "Sheet 1" (Work)	✓
[-] Detail "DETAIL@1"	✓
[-] Imported "Isomet..."	✓
[-] Imported "Top@7"	✓
[-] Projected "ORTH..."	✓
[-] Projected "ORTH..."	✓
[-] Parts List	
[-] Out of Date	
[-] User Expressions	
[-] Groups	

Dependencies

Details

Preview

The drawing shows a large rectangular shielding plate with a top flange. Key dimensions include a top flange width of 72.3, a main body width of 119.5, and a height of 237.5. Details A and B are shown as circular callouts. Material callouts specify 1/20N 1/2B EX and 1/2 EX. A note at the bottom right states 'APPROX. WEIGHT 140,574 LBS'.

NOTE 1

- ALL WELDING SHALL BE DONE IN ACCORDANCE WITH ANSI/AWS D1.1 STRUCTURAL WELDING CODE FOR STEEL. FILLER METAL SHALL BE E7018.
- ALL WELDING SHALL BE DONE BY WELDERS CERTIFIED FOR EACH PROCEDURE REQUIRED.
- VENDOR SHALL DETERMINE THE SEQUENCE OF WELDING AND HOLE DRILLING TO MINIMIZE DISTORTION AND ASSURES RESPONSIBILITY FOR ANY STRESS RELIEVING OR STRAIGHTENING.
- VENDOR MAY SUGGEST ALTERNATE WELD PREPS SUBJECT TO FINAL ENGINEERING APPROVAL.

QTY	PART NUMBER	DESCRIPTION	UNIT
3	F10116574	TALL SHIELD BLOCK	1
2	F10116575	SHORT SHIELD BLOCK	1
1	F10112708	SHIELD SPACING SHIM	1
		FOR SPACING	

APPROX. WEIGHT 140,574 LBS

UNLESS OTHERWISE SPECIFIED	DESIGNED BY	DATE	27-Aug-2018
DESIGNED BY	DESIGNED BY	DATE	DATE
APPROVED BY	APPROVED BY	DATE	DATE
DATE	DATE	DATE	DATE

PERMITS DIVISION, REGULATORY LABORATORY
UNITED STATES DEPARTMENT OF ENERGY

TALL-SHORT SHIELD BLOCK WELDMENT (R)

MATERIAL: NONE
 HOLE: D F10116572
 SHEET: 1 of 1

Procurement Planning

The procurement is planned to start in January 2025.
The procurement plan and specification will be developed.
The Fermilab and Vendors responsibilities will be signed.

MSD Procurement Specification Template, ED0005394, Rev. -

MSD Procurement Specification Template, ED0005394, Rev. -



SDF/SDFW Procurement Specification

1.0 Safety and Completeness

The fabricated parts must adhere to the provided drawings. If information is missing on the drawing or more information is needed, the engineer and or fabrication specialist must be contacted via email.

Engineer Contact info

Name: Vladimir Sidorov

Phone: 630 840 6358

Email: sidorov@fnal.gov

Fabrication Specialist Contact info

Name: Greg Bulat

Phone: 630 840 4433

Email: bulatg@fnal.gov

2.0 Fermilab Responsibilities

2.1 Drawing Numbers Submitted:

F10035613	F10035615	F10035626	F10035629
F10035630	F10035632	F10035634	F10049039
F10049044	F10035614	F10035617	F10035637
F10035638	F10070710	F10070790	F10035604
F10035621	F10035641	F10068801	F10070846
F10035596	F10035618	F10068815	F10068850
F10068851	F10068853	F10068854	F10068859
F10068861	F10068863	F10068864	F10068865

2.2 Assemblies

Do Items require assembly? Yes: No:

If yes, drawing numbers that need to be delivered as an assembly:

F10068852	F10068790	F10070844	F10070709
F10070611	F10070863	F10070847	F10070645
F10070861	F10070771	F10070782	Click here to enter text.
Click here to enter text.			

2.3 Other applicable items Fermilab will include:

None:

Tooling:

Parts/Hardware:

Material:

Other: Click here to enter text.

2.4 QC inspection report from vendor

QC inspection report required? Yes: No:

If QC inspection is required, see section 3.2 for more detail.

3.0 Vendor Responsibilities:

3.1 Certificates/Documents Requested:

Material Certificates:

Heat Treatment Documents:

Welding Documents:

Coating Certificates:

Other: Click here to enter text.

3.2 QC Inspection Report:

If a vendor QC inspection report is required, vendor to provide an inspection report showing measurements of all dimensions with the specified tolerance stated on the drawing. These inspections should be at random. The vendor is allowed to use their own inspection report if they have one. If the vendor does not have an inspection report, they are to use the inspection report provided by Fermilab. Percentage of items to be QC is up to the discretion of the engineer and is listed below.

Percent of items to be inspected: Choose an item.

If small amount, specific items to be inspected: 3 single point weldments (F10027341) and 3 double point weldments (F10027342)

Items that do not pass QC inspection by vendor will get remade at the vendor's expense unless vendor is given approval by Fermilab Project Engineer to keep item. If the above inspected amount does not pass, the percentage of items to be inspected will be increased to 100%.

3.3 Incompleteness:

In the event of incompleteness or error in Fermilab supplied drawings, the vendor shall notify Fermilab to obtain design directives.

3.4 Hardware

Any hardware supplied or part of an assembly shall be as per print. The use of counterfeit hardware is strictly forbidden.

3.5 Markings

Each shipping piece or assembly will be clearly marked with the drawing number with a stencil or marker as detailed on print. If detail is missing on print, the engineer and or fabrication specialist should be notified.

3.6 Cleanliness

The vendor shall follow the notes on the drawings and at a minimum, the part must be free of dirt, grease, oil, chips, and burrs.

3.7 Plated/ Painted Surfaces

The vendor is responsible for the plating or painting of all surfaces called out in the drawing. If vendor have to send the parts out to get coated/painted, vendor shall contact Fermilab to get suggestions on Fermilab approved coating/painting vendors.

3.8 Welds

All welds shall be to print and comply with the American Welding Society (AWS). Steel welds shall comply with ANSI/AWS D1.1 section 5.

If welds symbols are missing or unclear, vendor shall contact Fermilab.

4.0 On-site Inspections

On-site inspections by Fermilab Personnel required: Yes: No:

If Yes, at what stages?

1. Choose an item.
2. Choose an item.
3. Choose an item.
4. Choose an item.
5. Choose an item.

If other, list stage: [Click here to enter text.](#)

5.0 Technical Milestones

It is the responsibility of the vendor to ensure that the workforce and equipment supplied are sufficient to meet the schedule milestones. If required, vendor must contact Fermilab at each milestone before moving on.

Vendor responsible for supplying a schedule and contacting Fermilab for Technical Milestones:

Yes: No:

If yes, what following milestones:

1. Material delivery
2. Assembly Completion
3. Other
4. Vendor QA inspection
5. Shipping date

If other, list milestone: After Painting

6.0 Quality Assurance

Within two weeks of arrival, Fermilab will review the following:

6.1 Welds

Welds should be to print and comply with the American Welding Society (AWS). All welds will be subject to a visual inspection at a minimum as specified in ANSI/AWS D1.1 section 6.9.

6.2 Dimensions

After assembly, overall dimensions and all adjustors for free movement and full range of motion will be checked.

6.3 Coating/ Painted surfaces

Painted or black oxide surfaces should be inspected to ensure that all specified surfaces are painted and that it is uniform coverage. Sliding surfaces or threads should not be painted, as per the print.

6.4 Acceptance

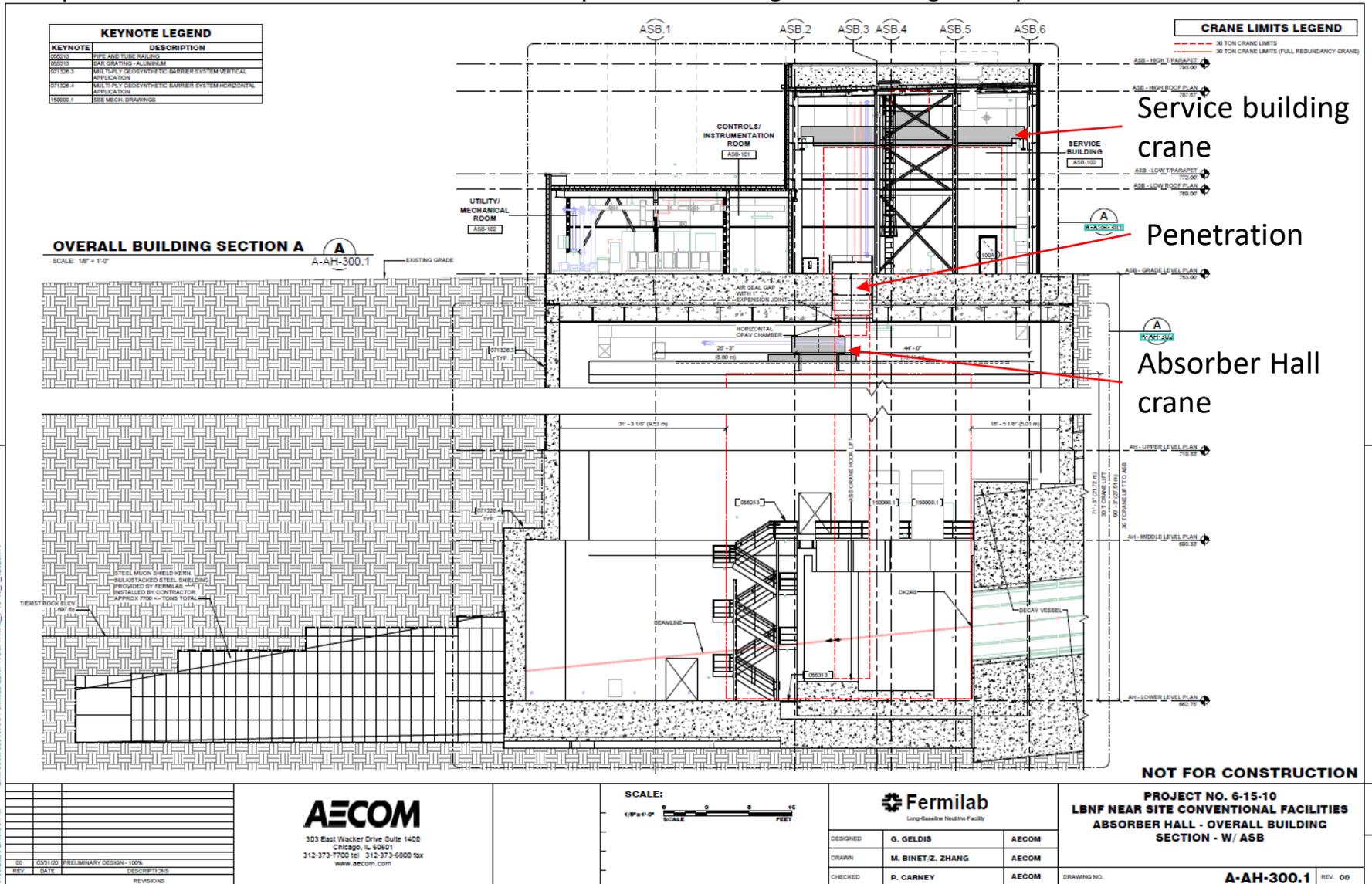
If the parts do not meet these specifications outlined in this document and the specifications on the drawings, the parts will be returned to the vendor at their cost for shipping and repair or to be remade.

7.0 Other/Extra Information

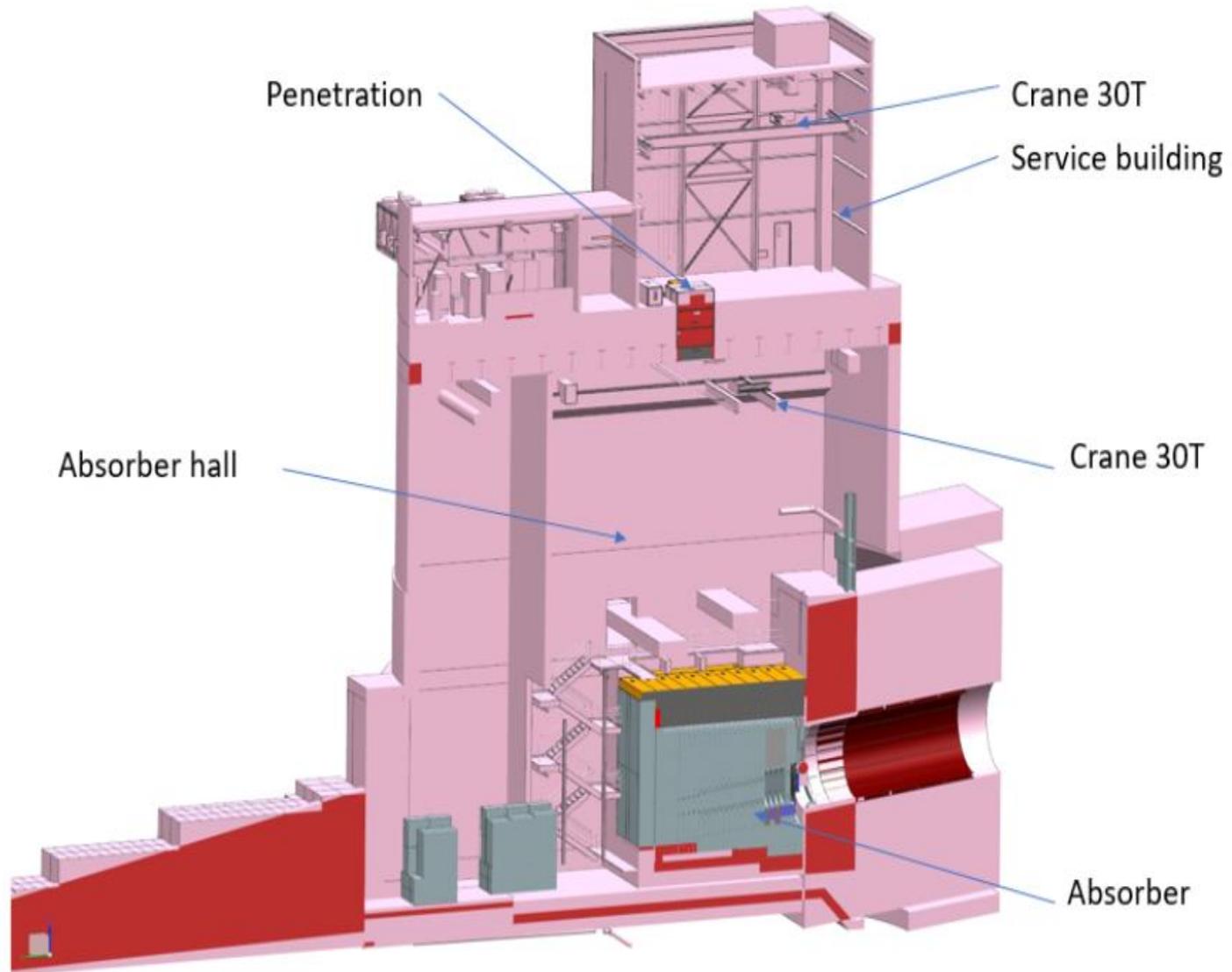
[Click here to enter text.](#)

Hadron Absorber assembly scheme

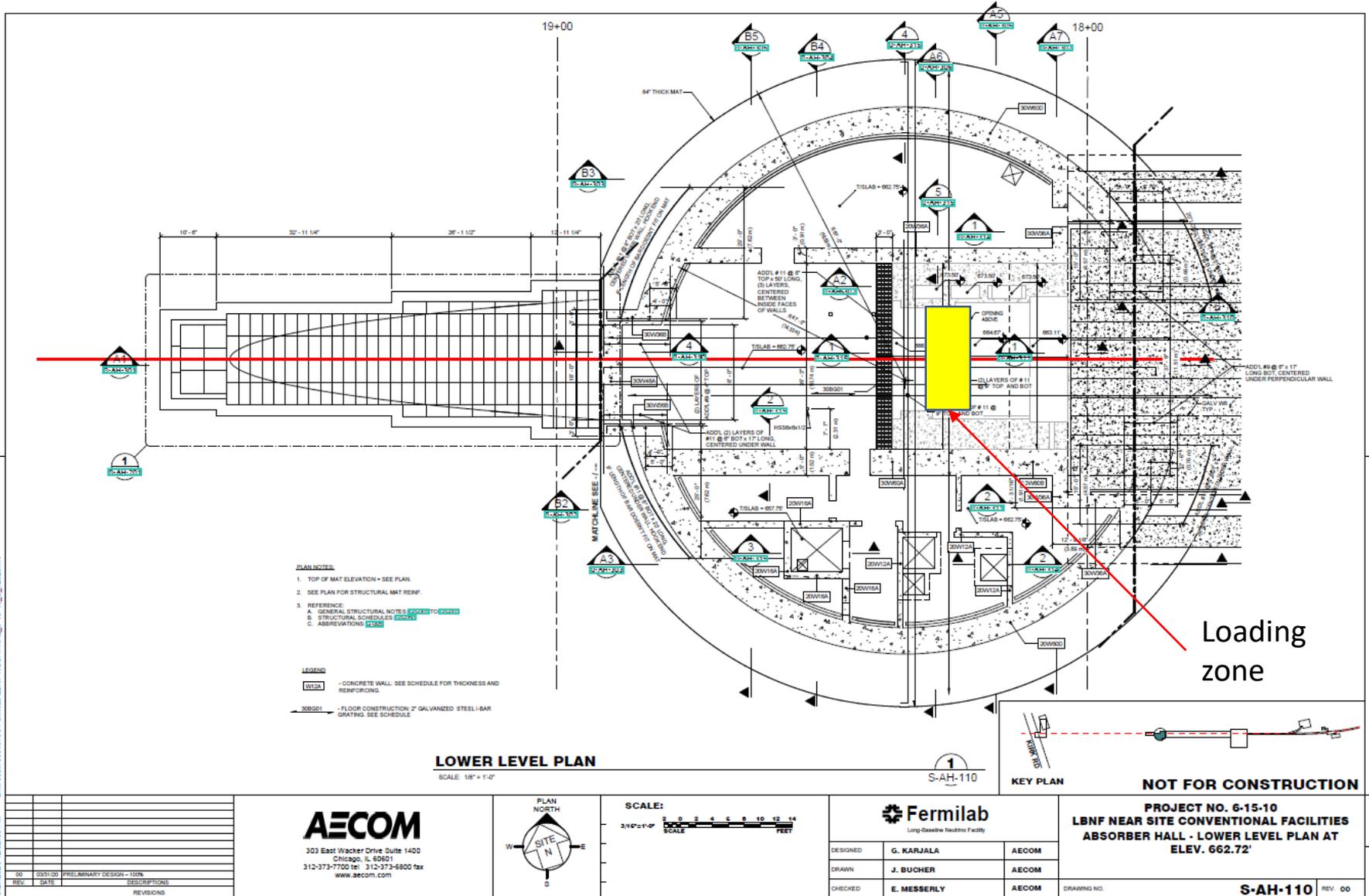
The absorber components will be installed by two 30 ton the service building and the absorber hall crane. Components are delivered to the absorber hall by service building crane through the penetration.



Absorber Complex Cross-section

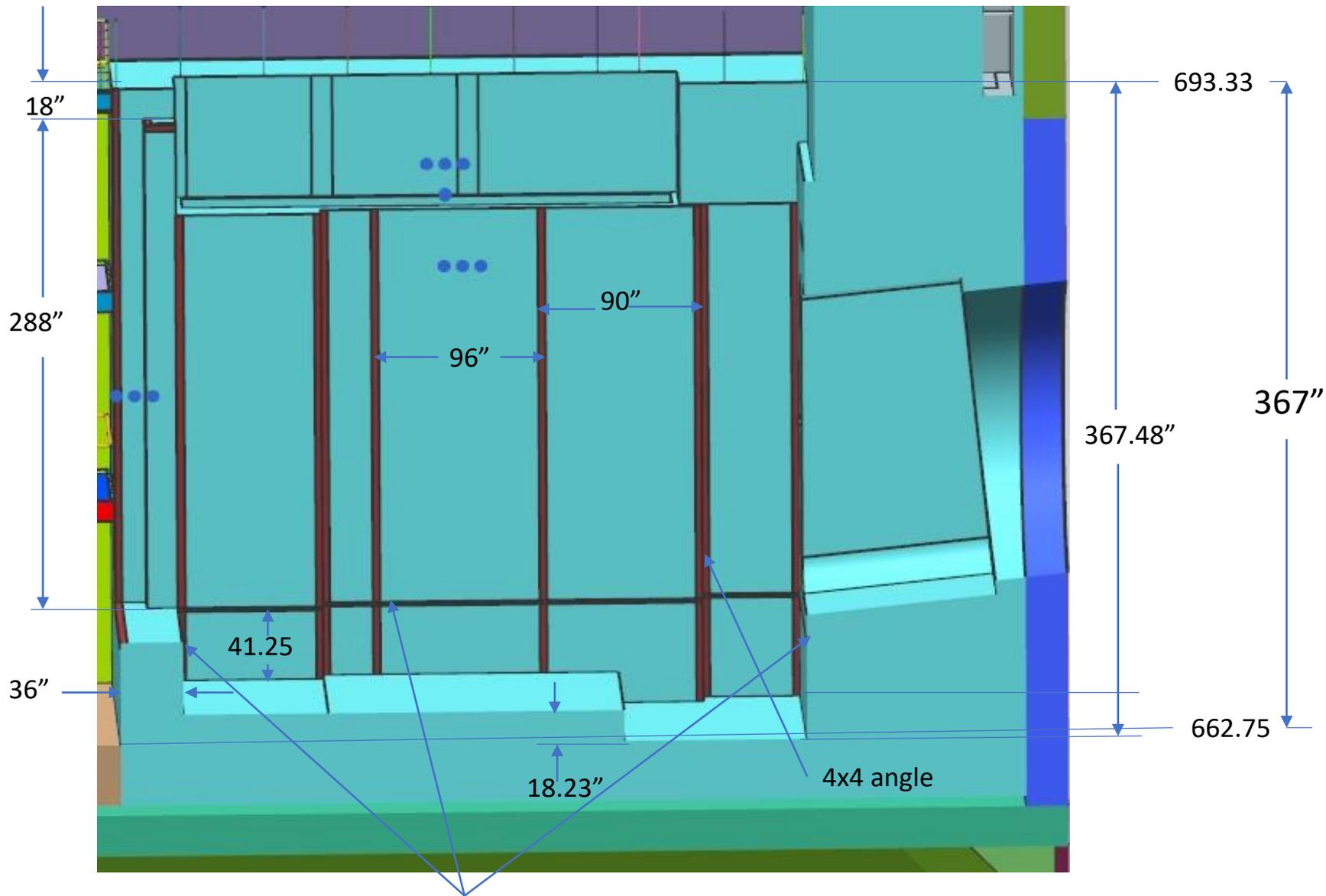


Absorber lower level plan view



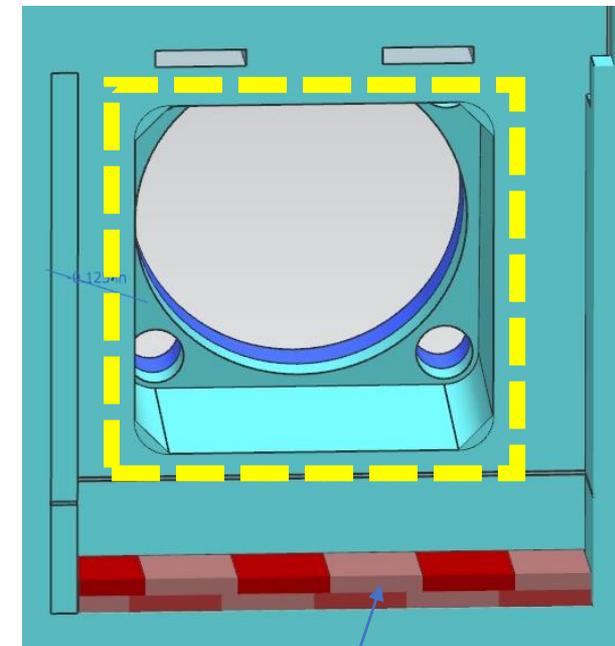
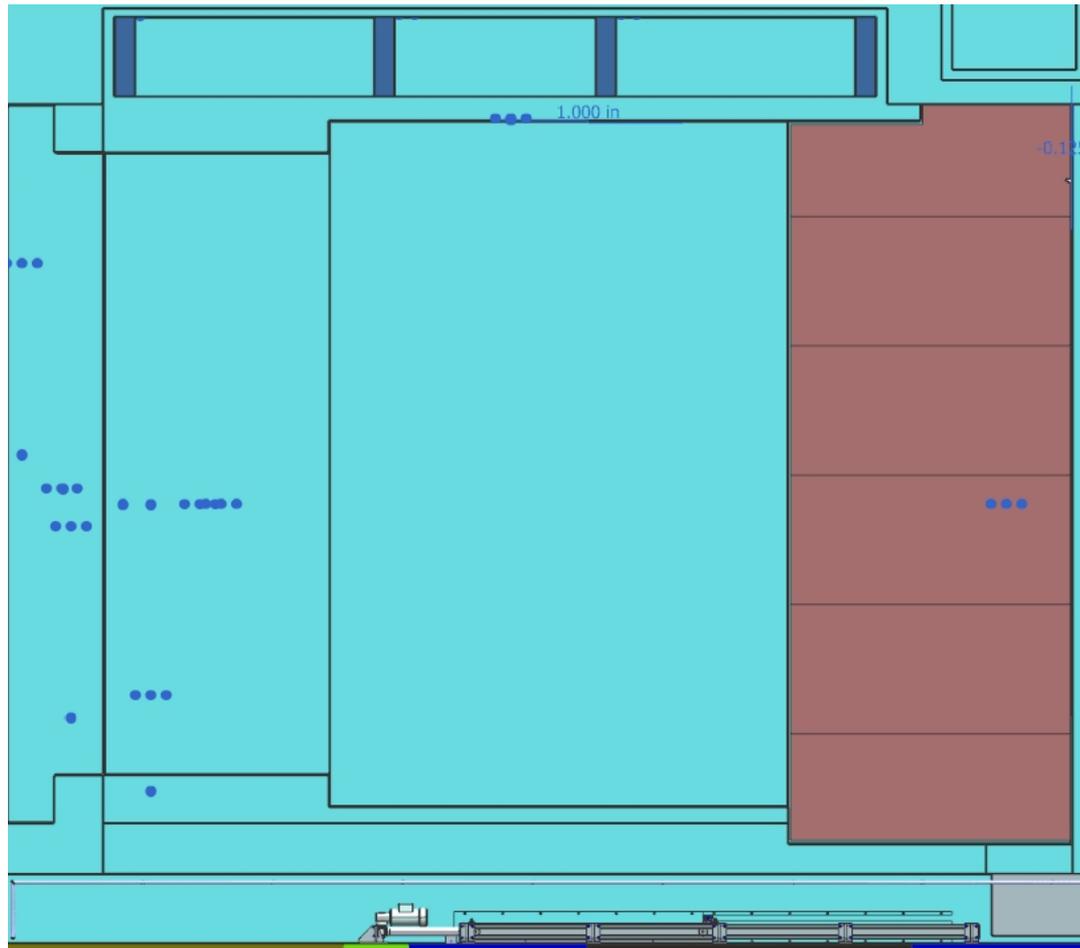
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Absorber concrete bunker



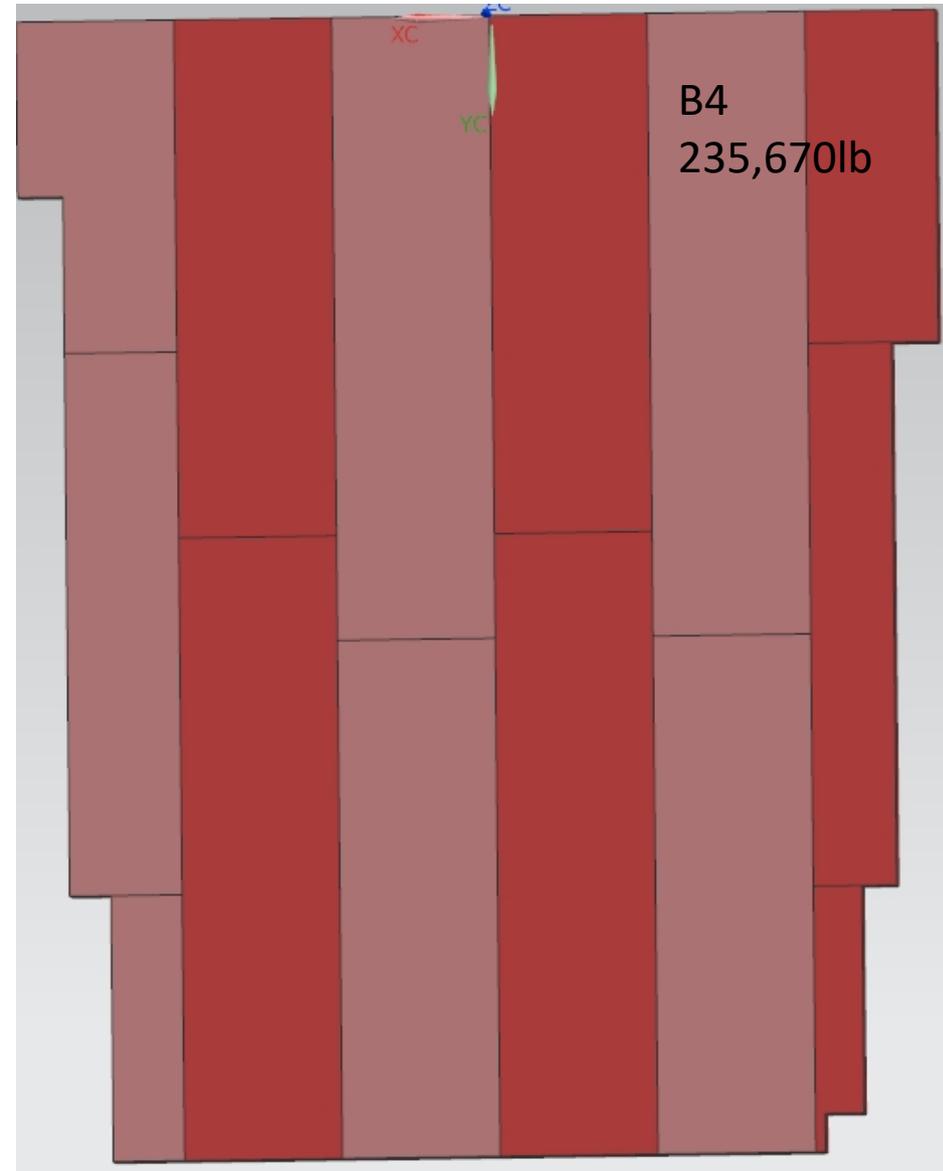
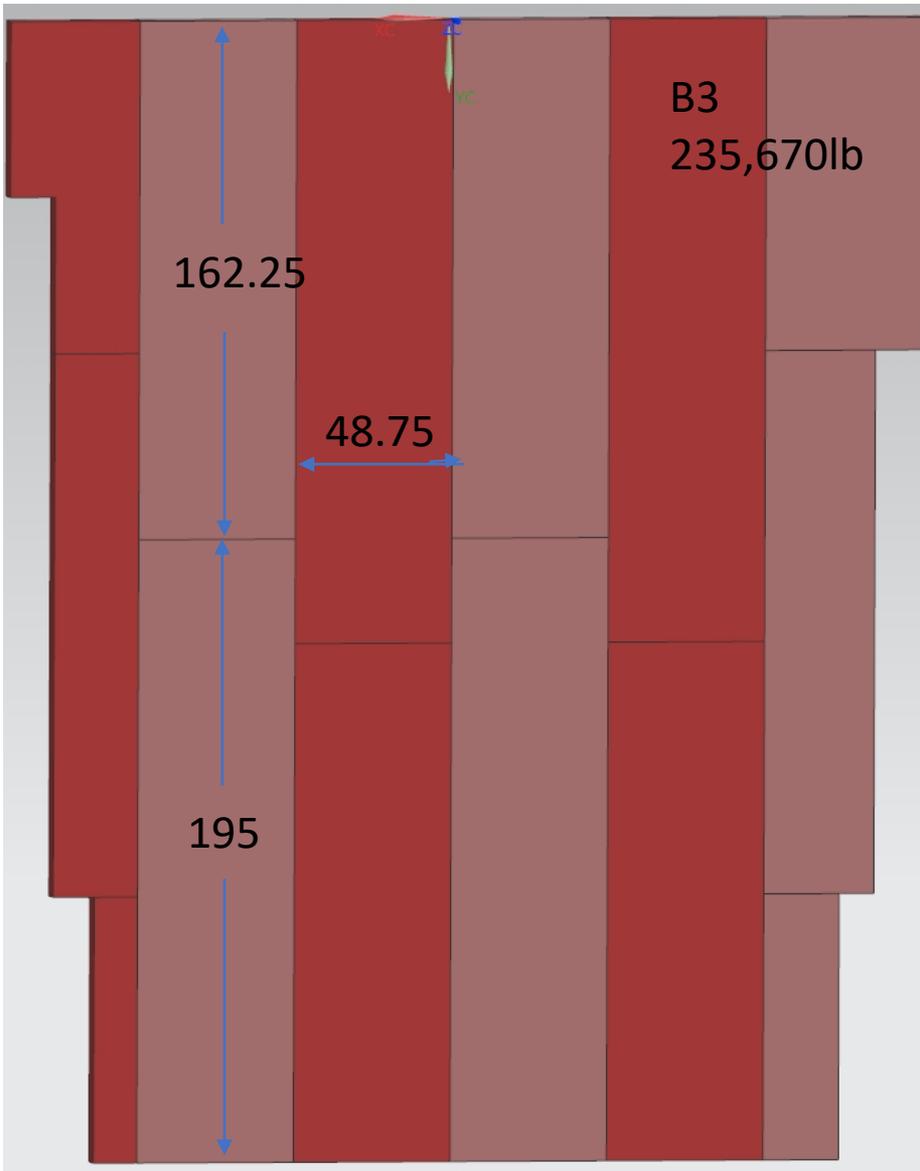
Bottom Steel shielding Layers 1 and 2 installation

The absorber steel shielding is welded from 9.11" steel plates, 48.75" width. The structure inside the yellow dashed square is the Decay Pipe downstream nitrogen turnaround and window. This will be installed before the absorber installation begins.

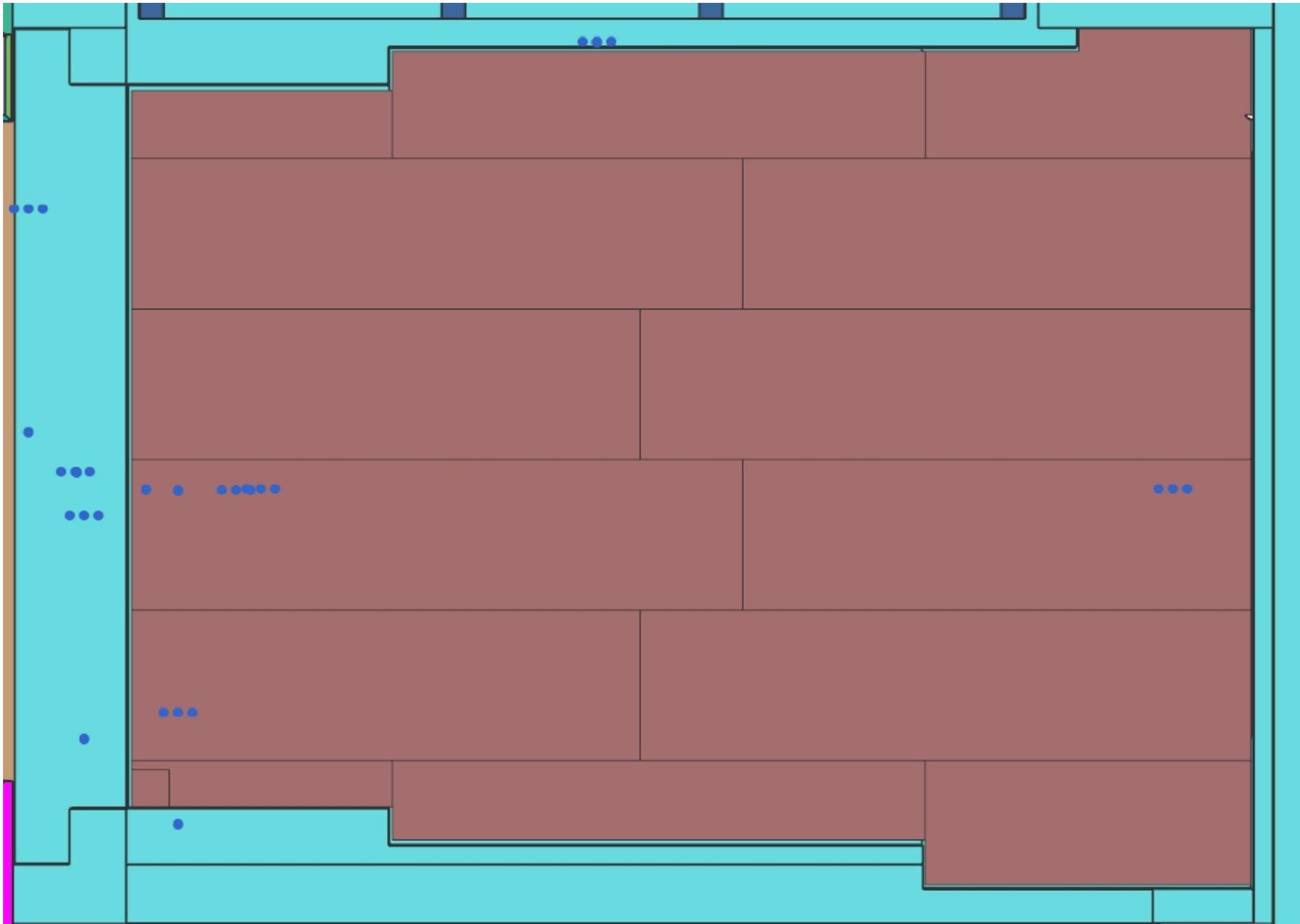


Steel plates

Steel shielding Layers 3 and 4, weight 235,670lb each

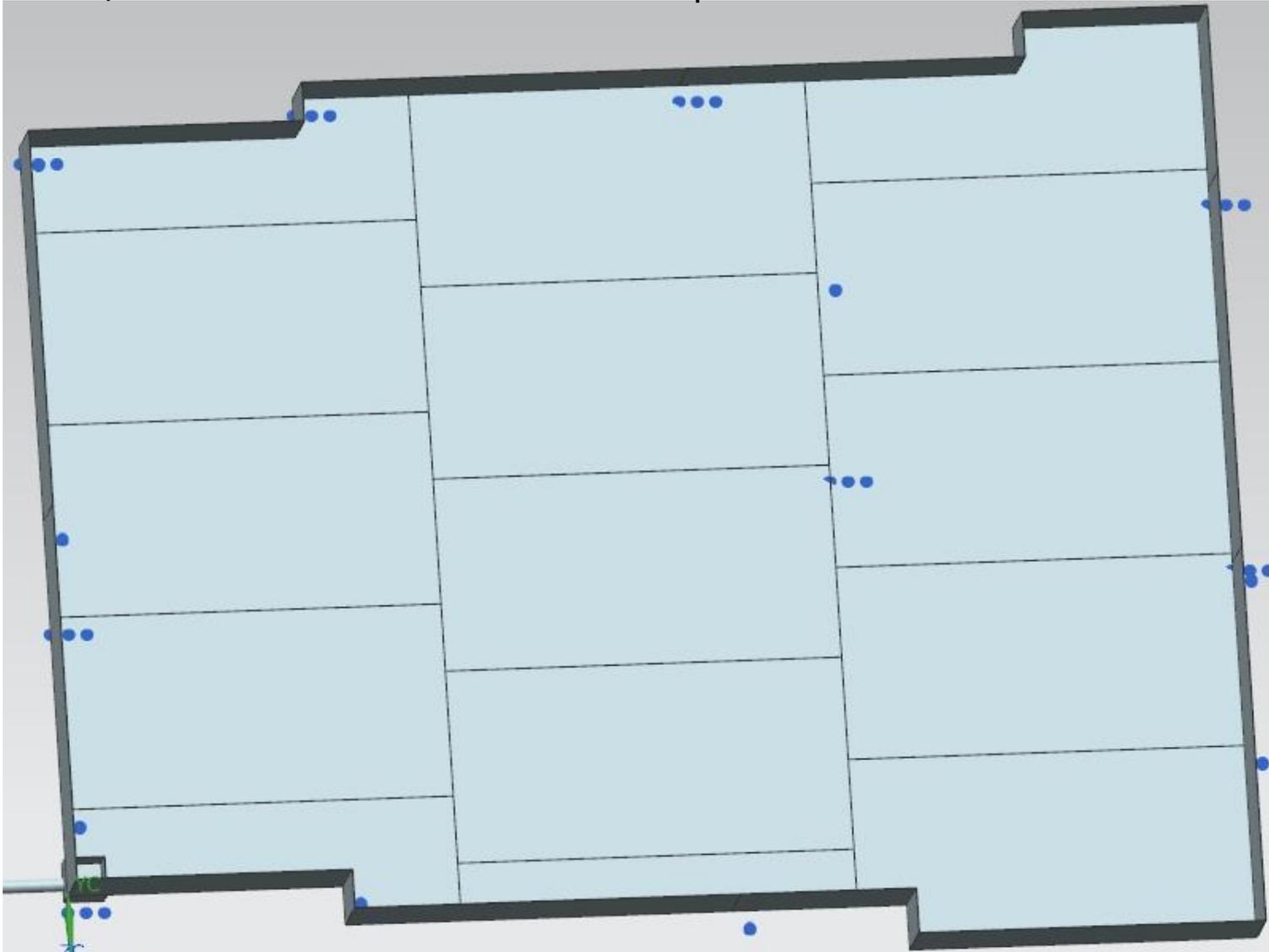


Layers 3 and 4 are installed

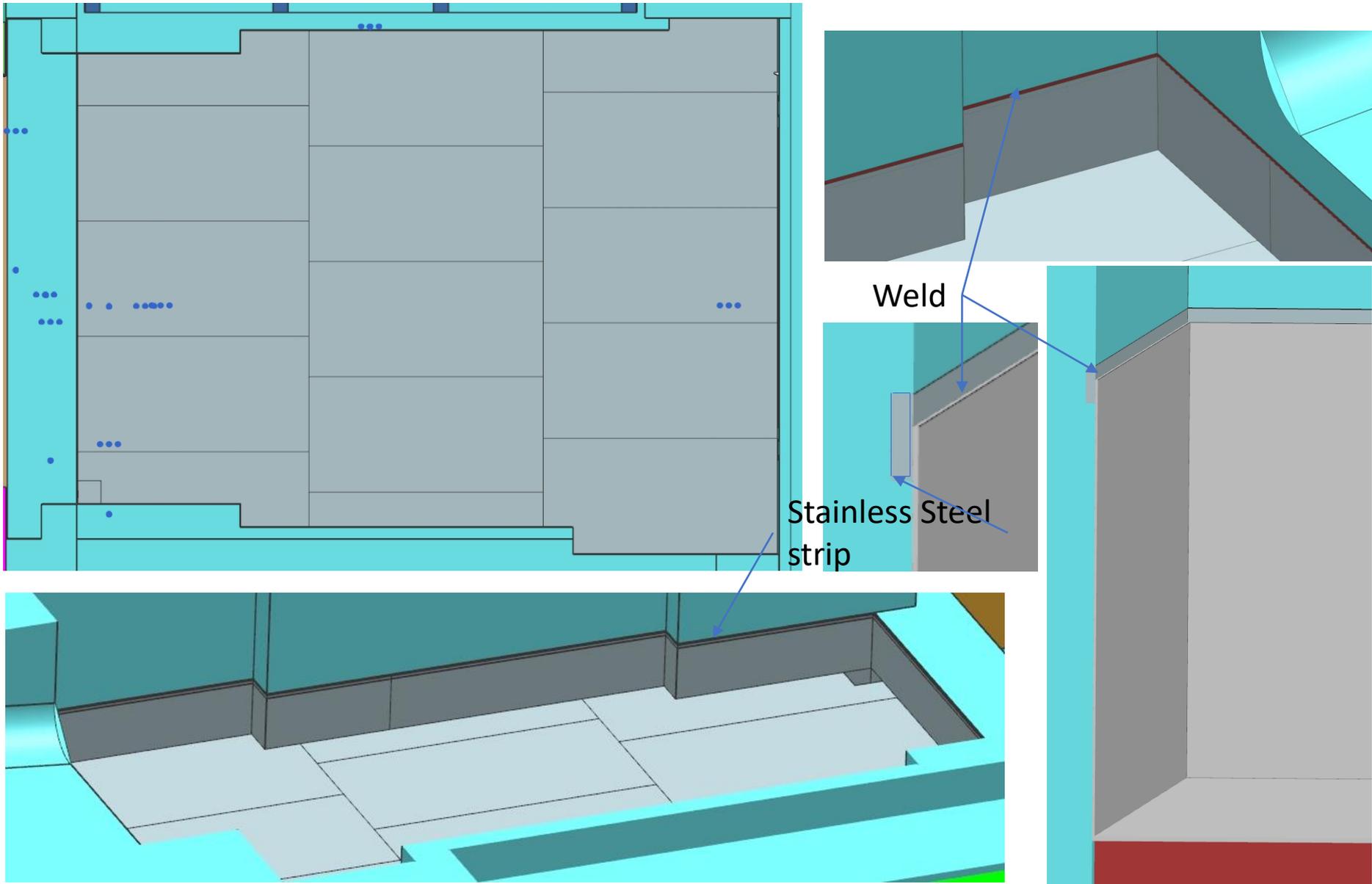


Radioactive water collecting pan

The pan is welded from the 48"x120"x 1/4" stainless steel base plates and side plates 24 " height and 1/8" thickness. The final weld of the pan is made in the absorber hall.

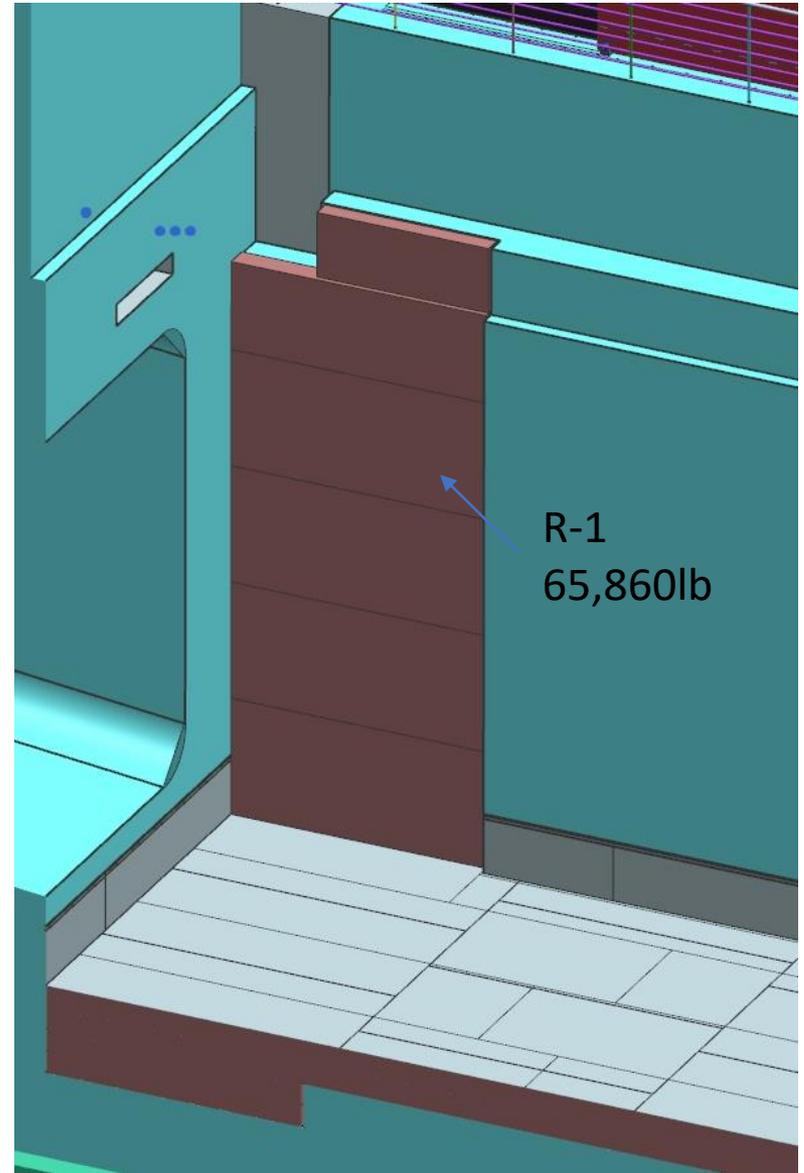
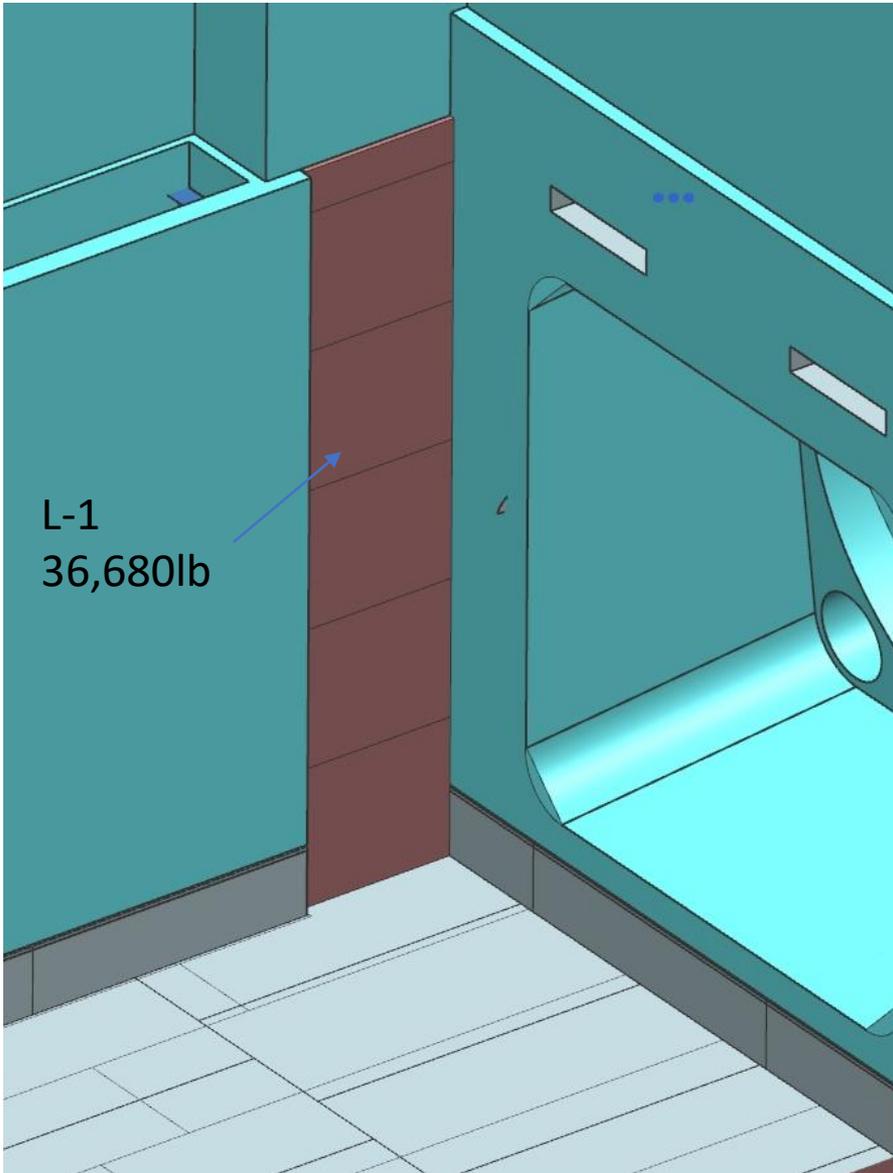


Side plates are welded to the penetrated into the concrete stainless steel strip.



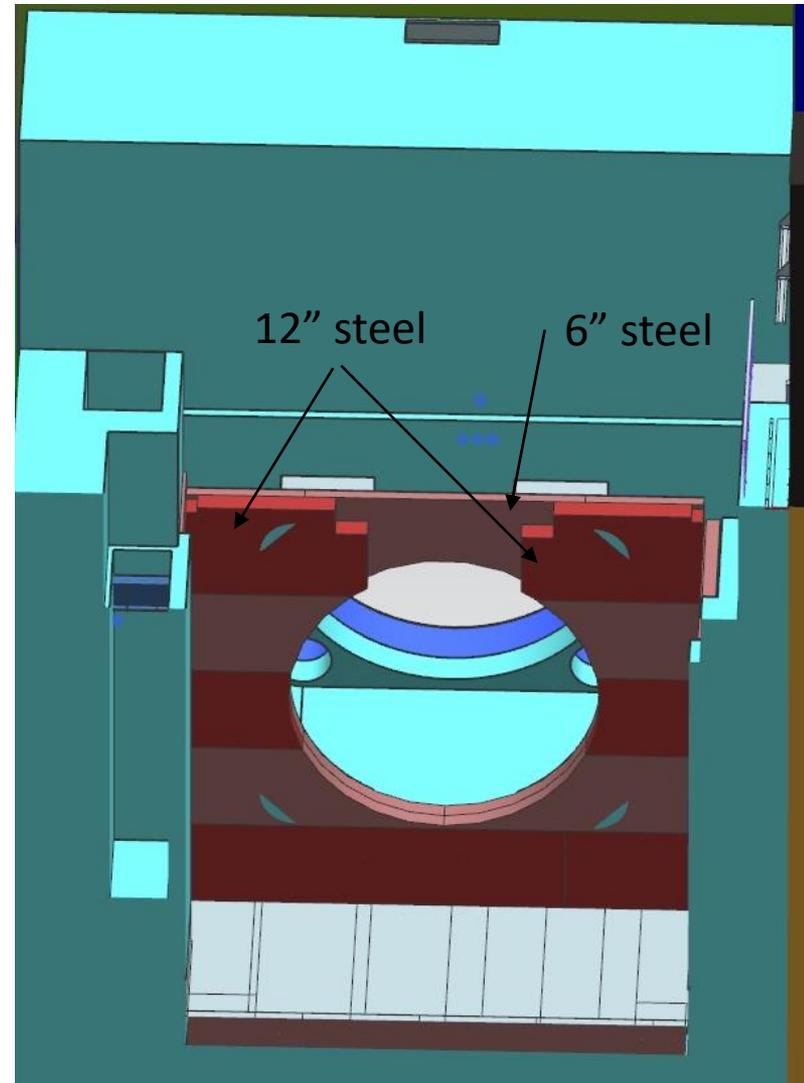
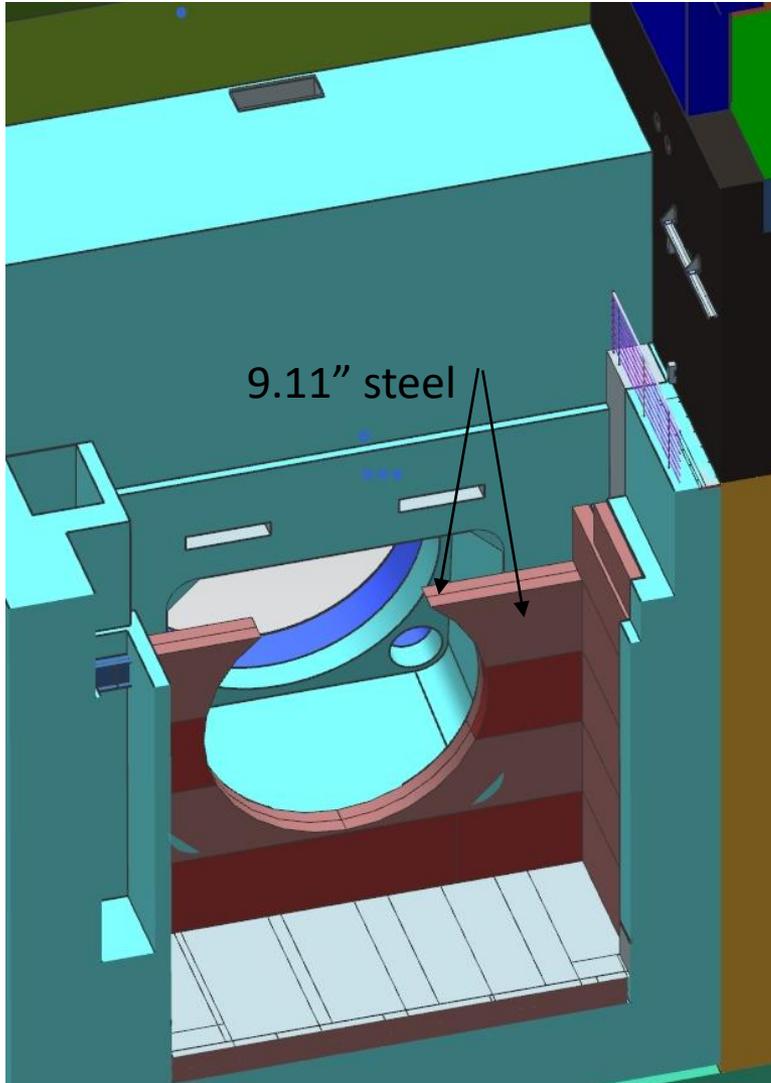
Vertical Right-1 and Left-1 Layers installation

Layers are welded from 9.11" steel plates 48.75" wide. The Right layer isn't covered by crane.



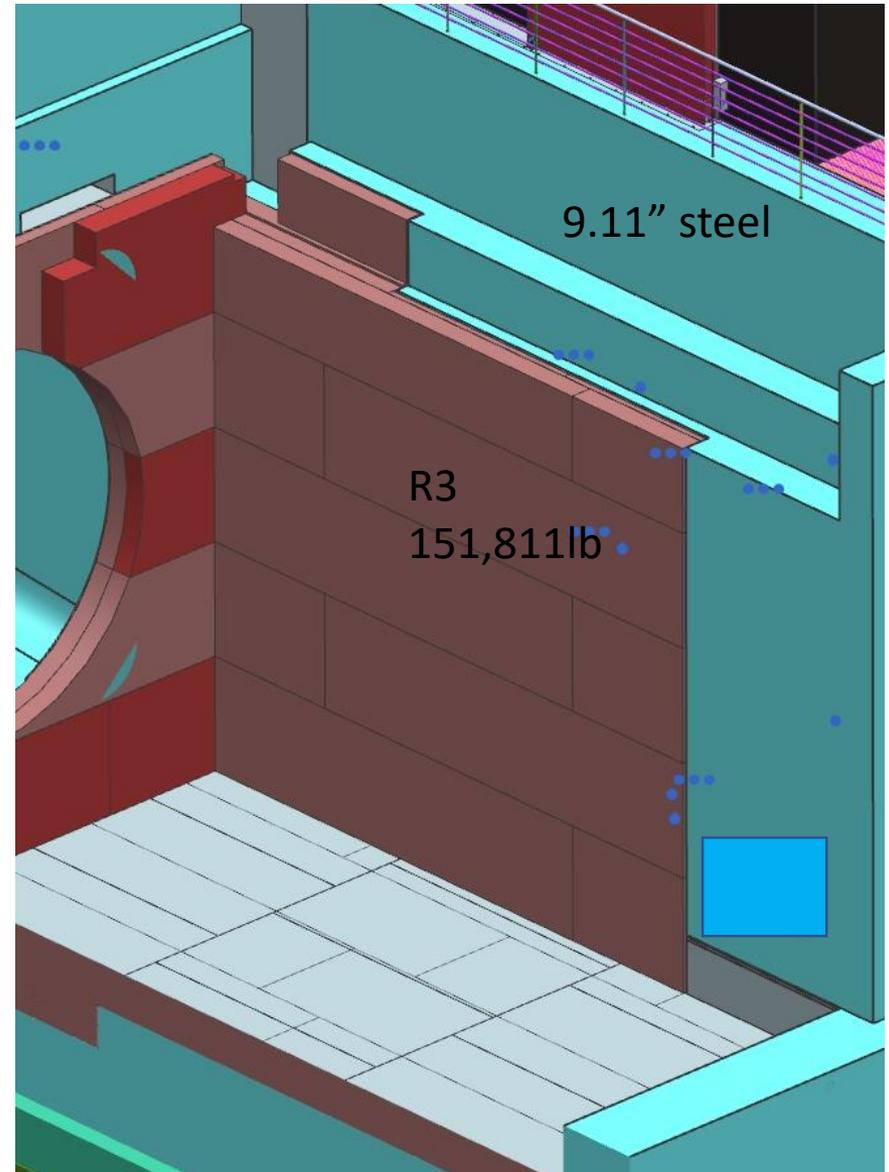
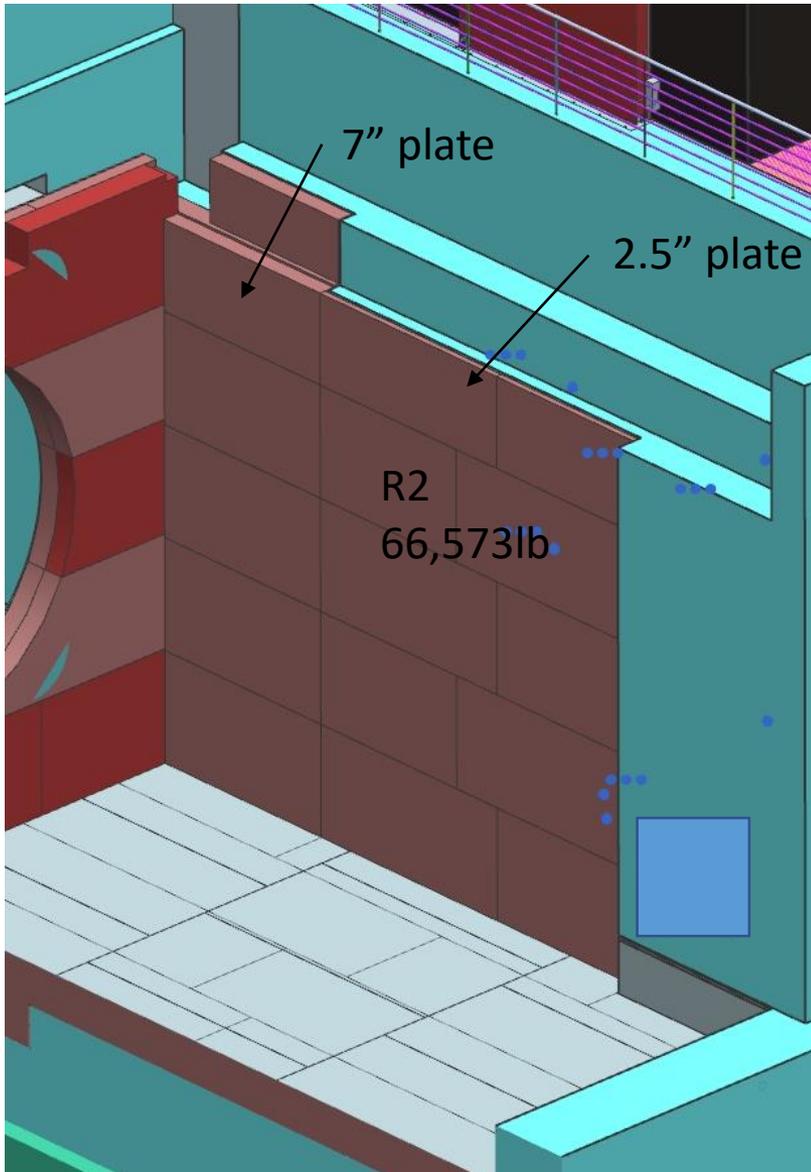
Two front layers installation

Front layers are welded from 9.11" steel. Only top plates are 12" and 6" thick.
Two layers weight -224,123lb

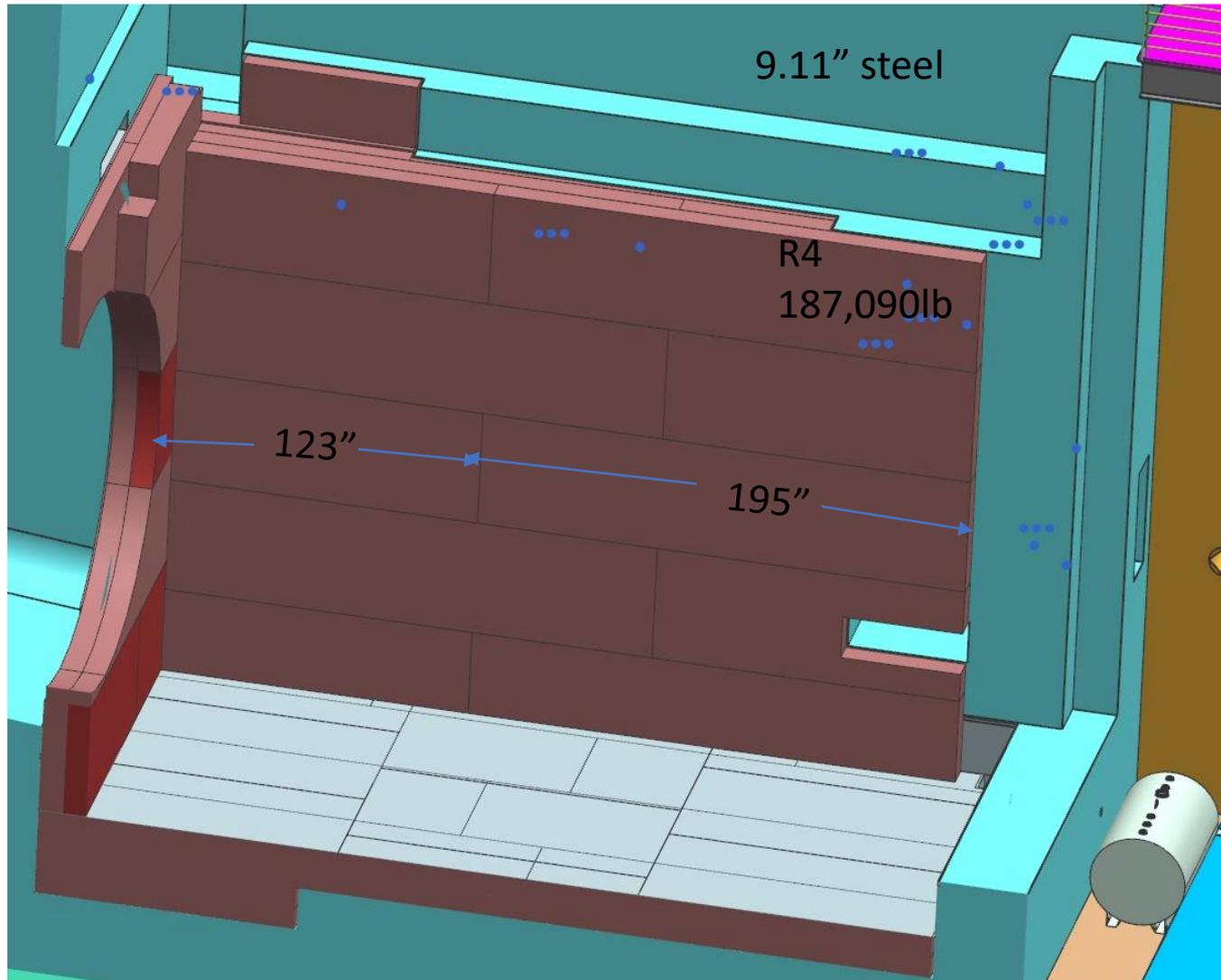


Right vertical layers-2 and -3 installation

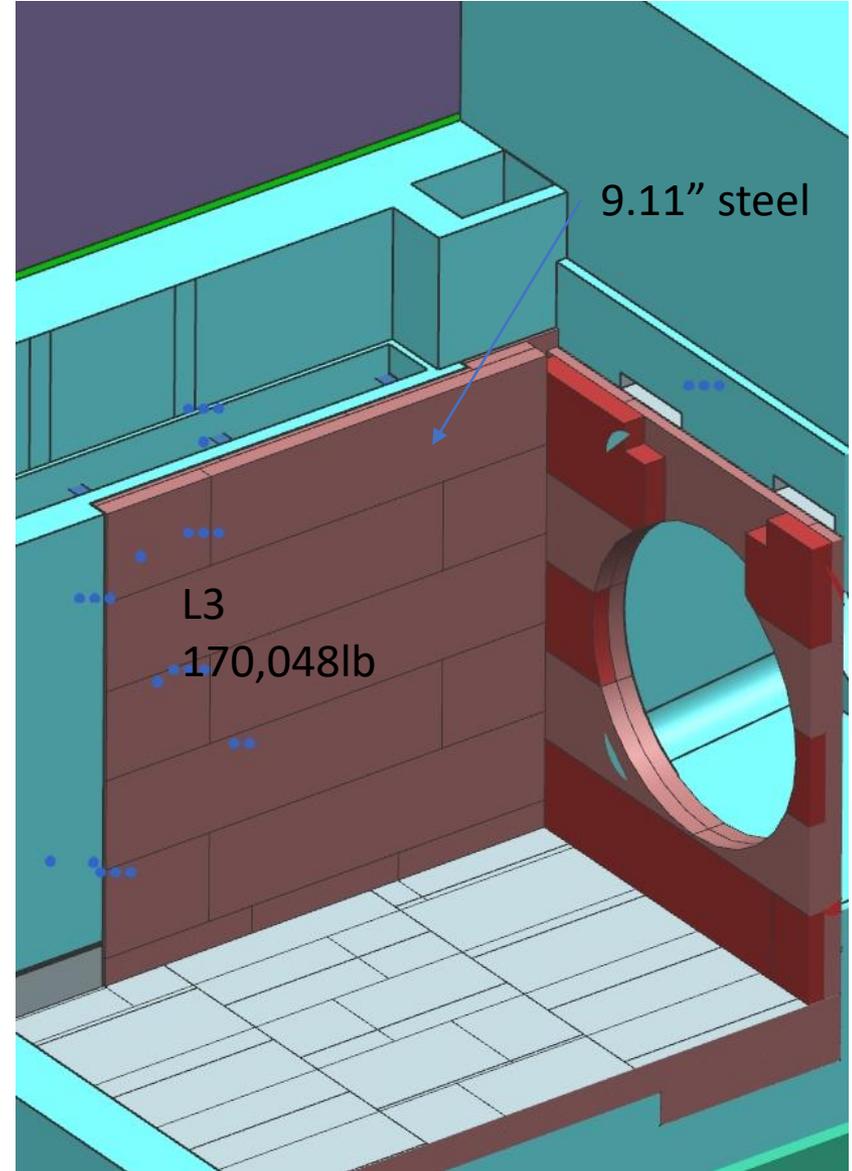
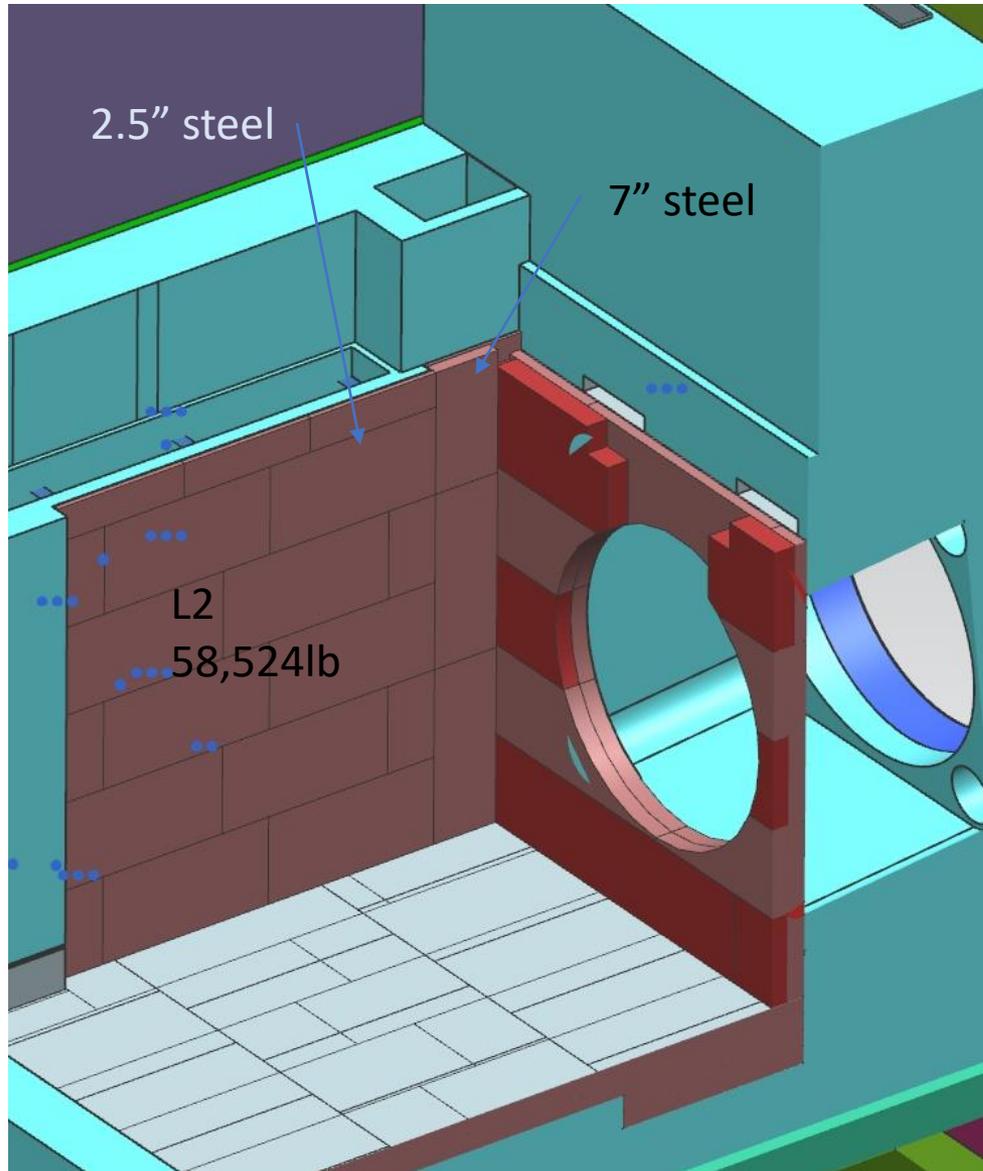
The Layer-2 is has 7" and 2.5" thickness and can be combined from different thickness plates.



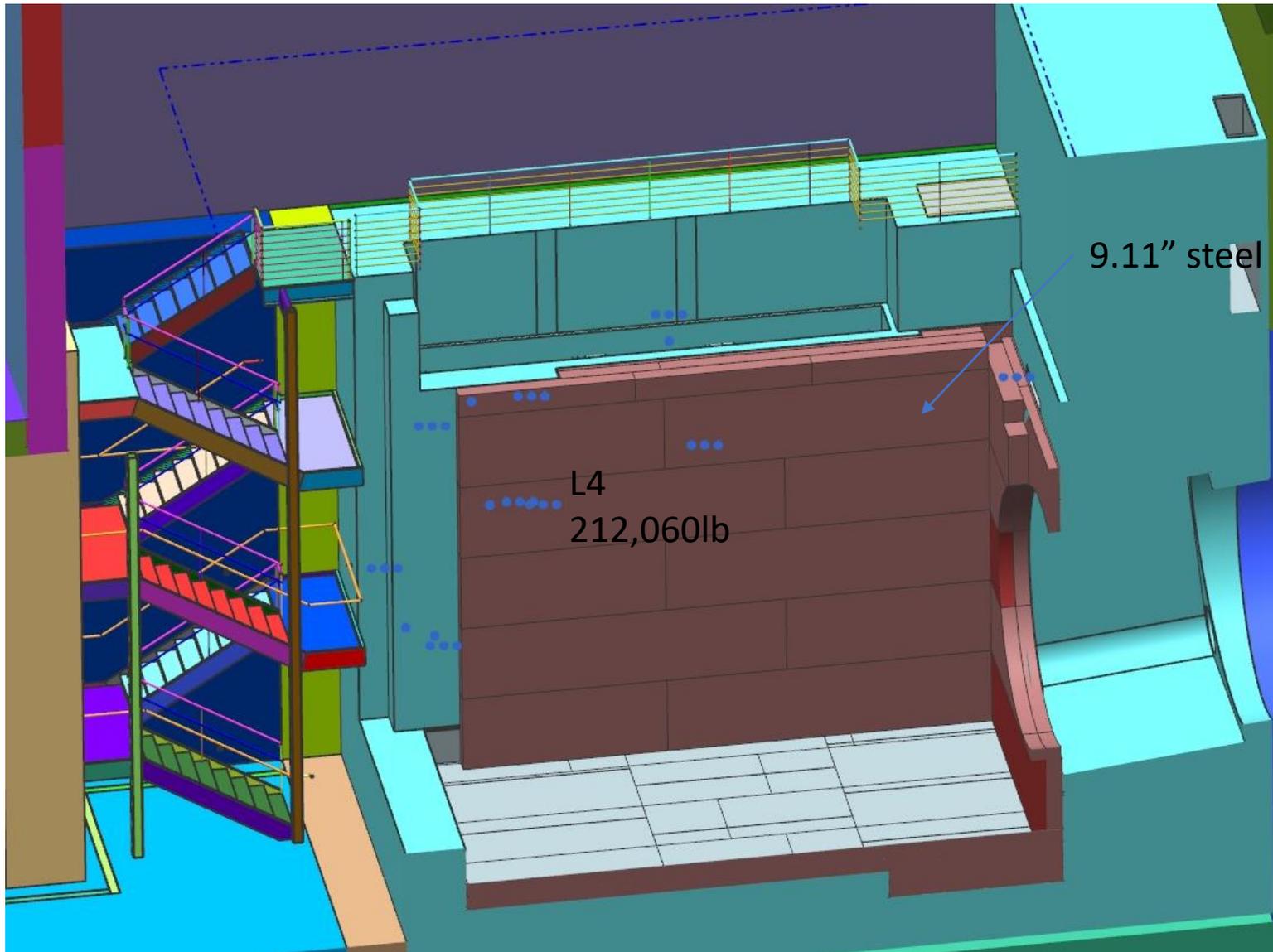
Vertical Right layer-4 installation



Left vertical layers-2 and -3 installation

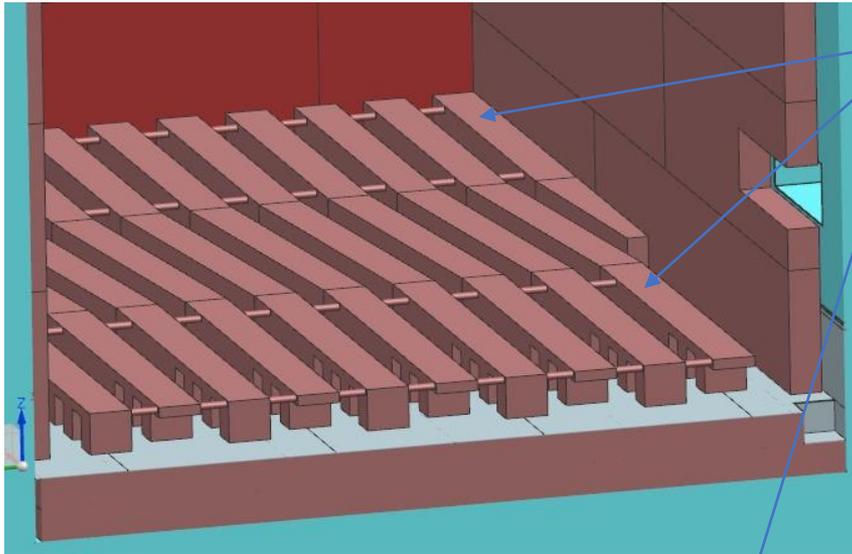


Left vertical layer-4 installation



Support blocks installation

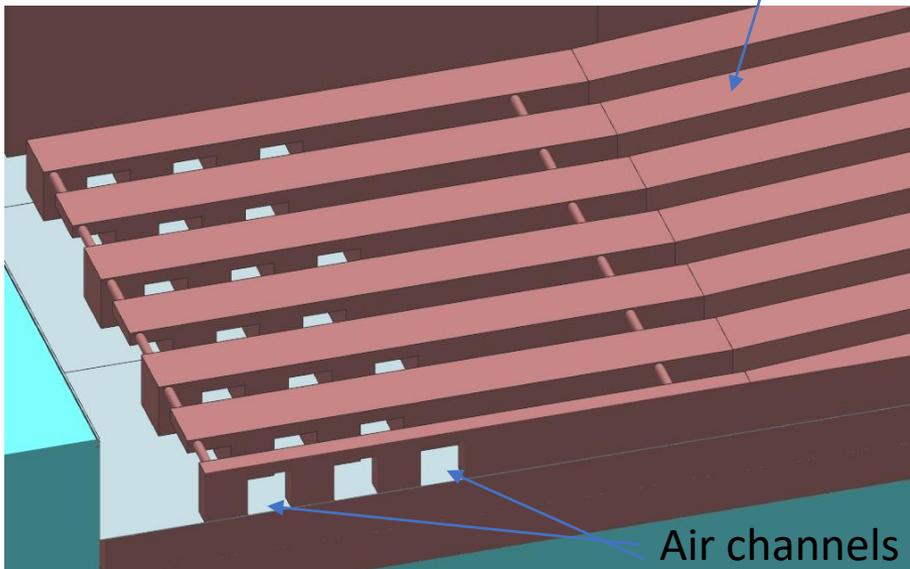
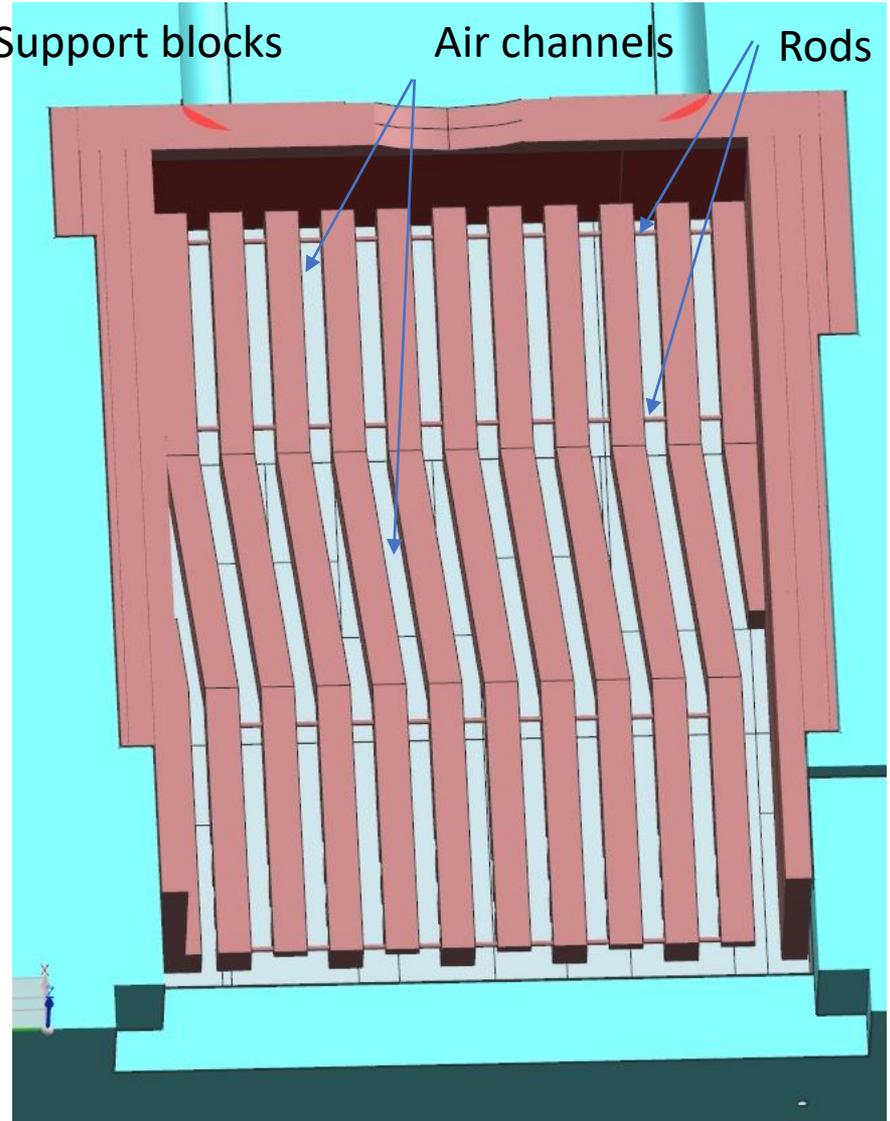
Steel 12"x12" blocks 10-113.5" long are installed on the stainless steel pan and joined together with steel rods. Blocks are not welded to the pan. The distance between block is eight inches.



Support blocks

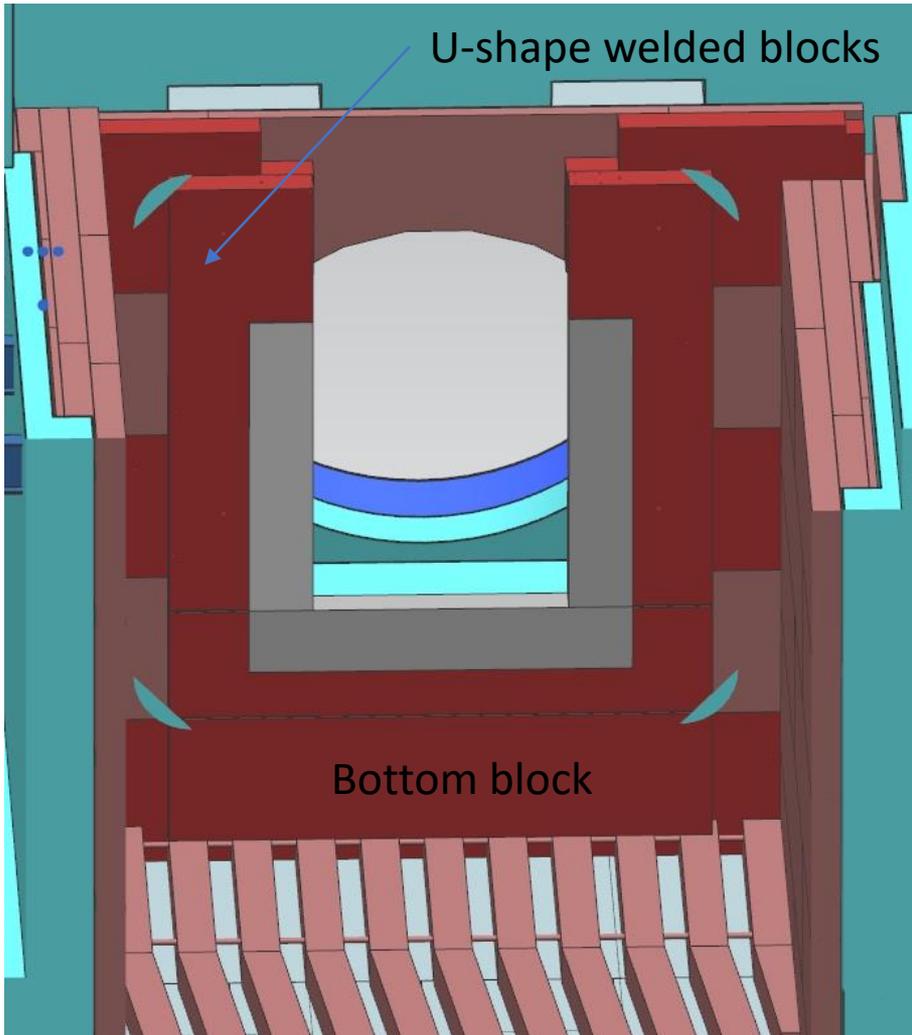
Air channels

Rods



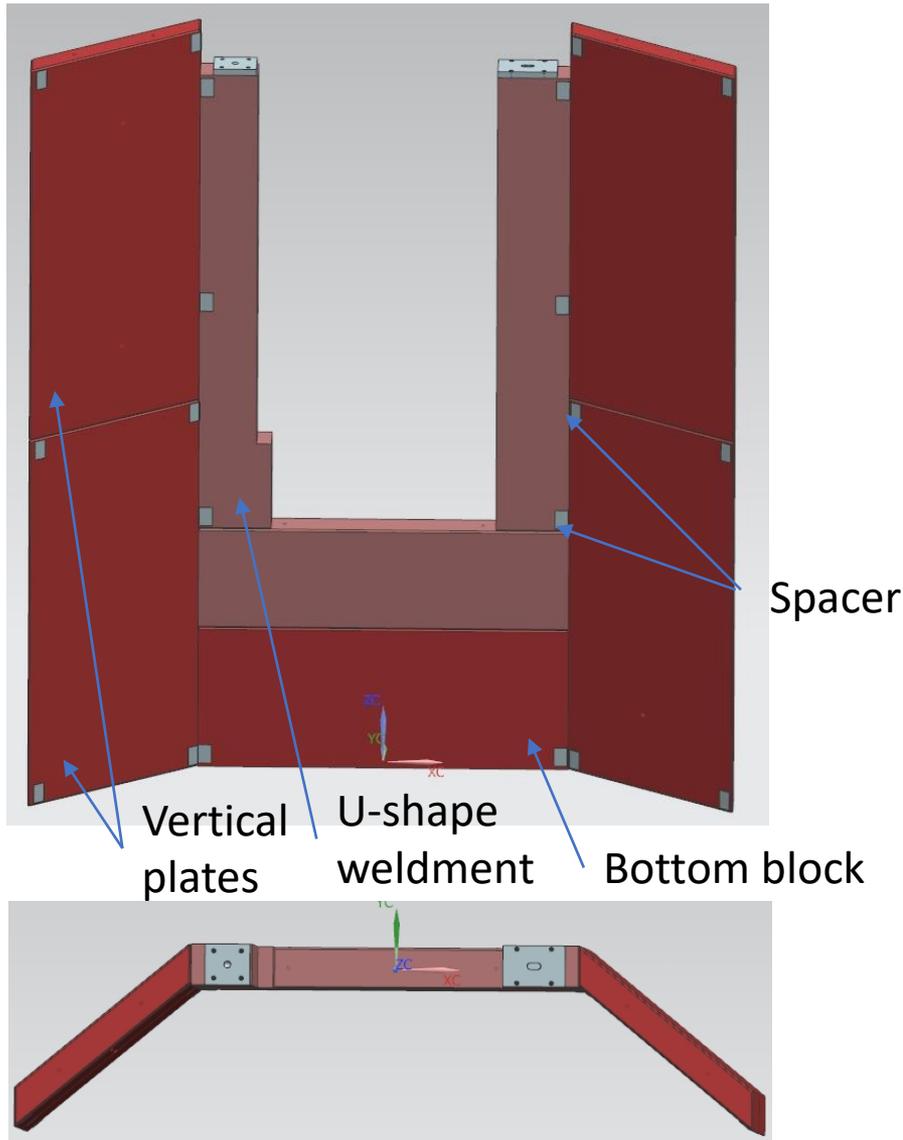
Air channels

Mask support structure and steel shielding are welded together layer by layer. The bottom block is installed, aligned and welded to support bottom blocks first, then U-shape module support structure with aluminum inserts.



Aluminum core blocks support structure and shielding installation

Aluminum core blocks support blocks and surrounded shielding are installed layer by layer.



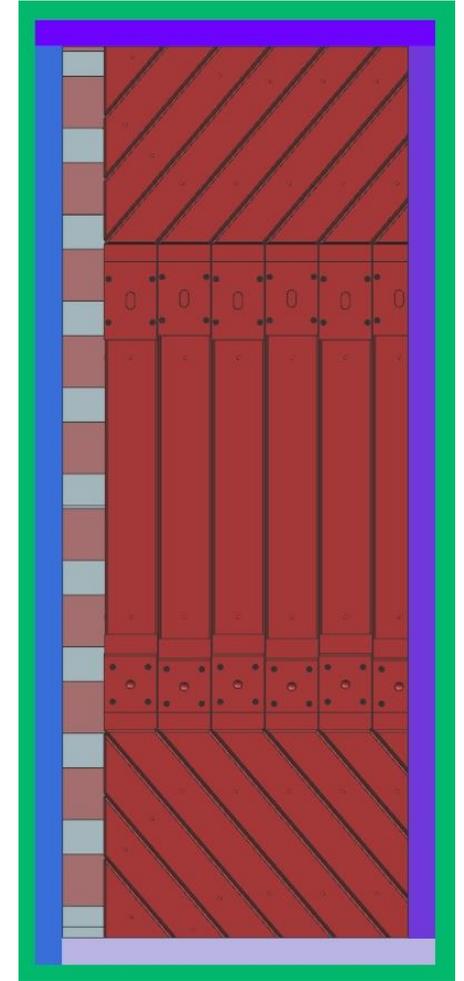
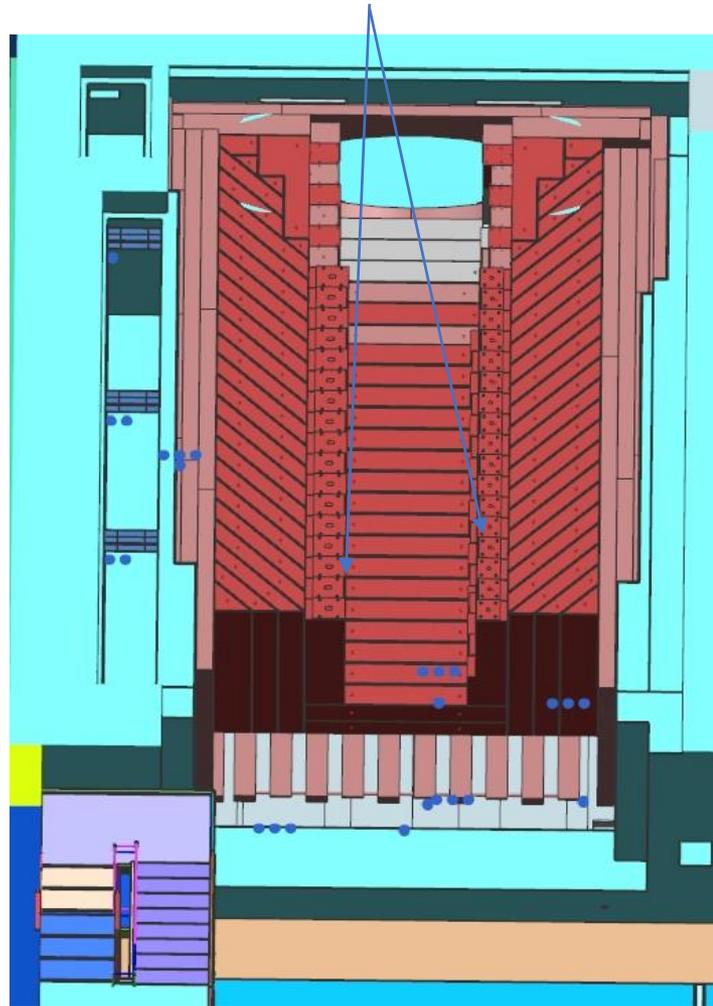
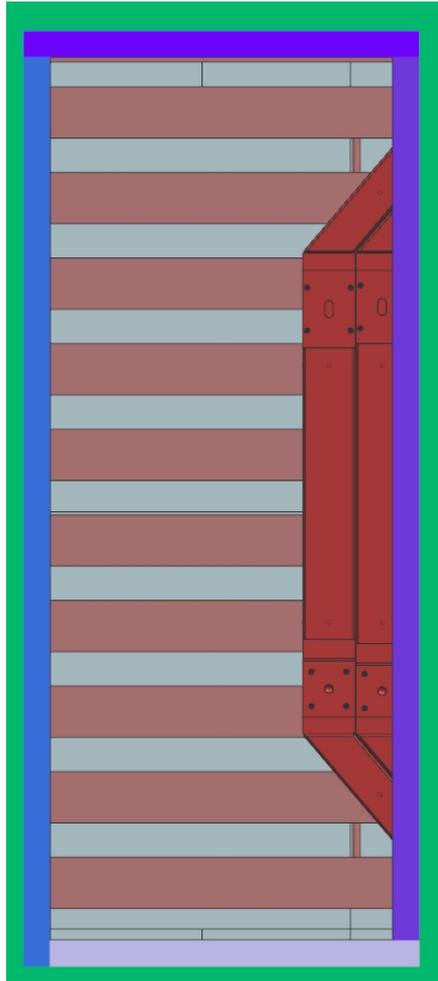
Steel core blocks support structure and surrounded shielding installation

Steel core blocks support structure is located under the service building hatch and can be installed by service building crane.

Hatch projection-before

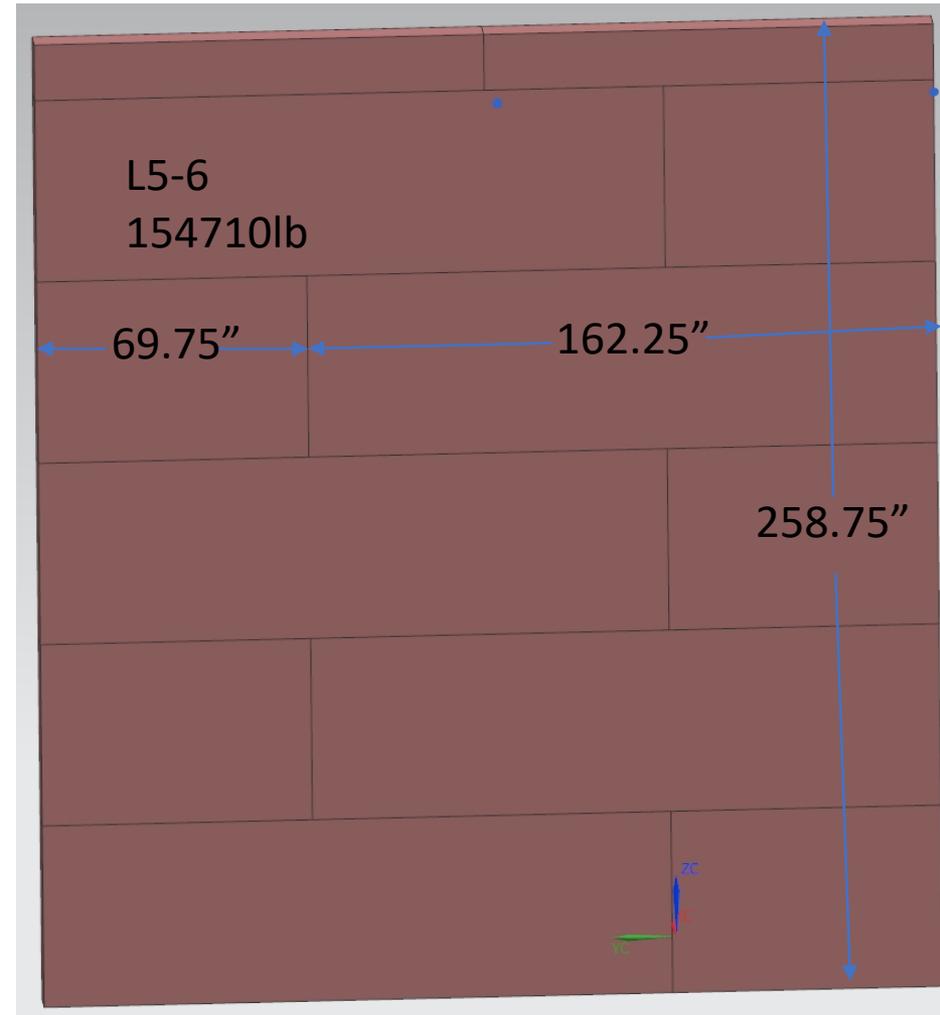
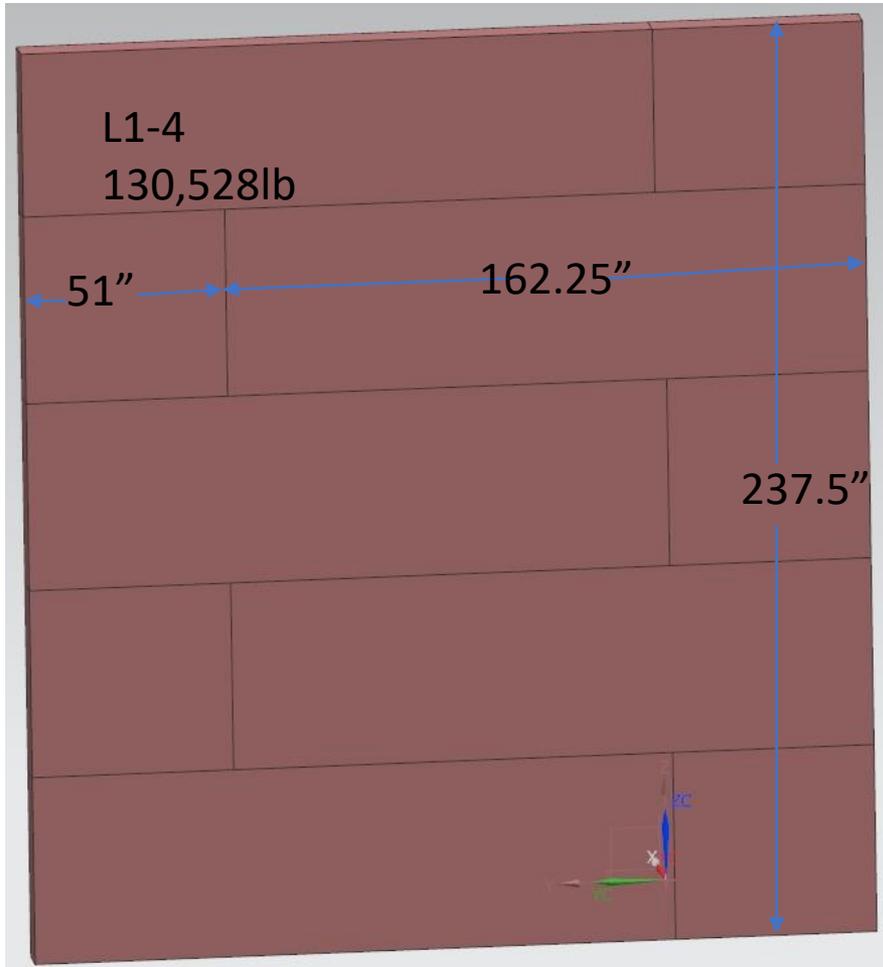
Steel core blocks support structure

Hatch projection-after



Downstream end steel shielding installation

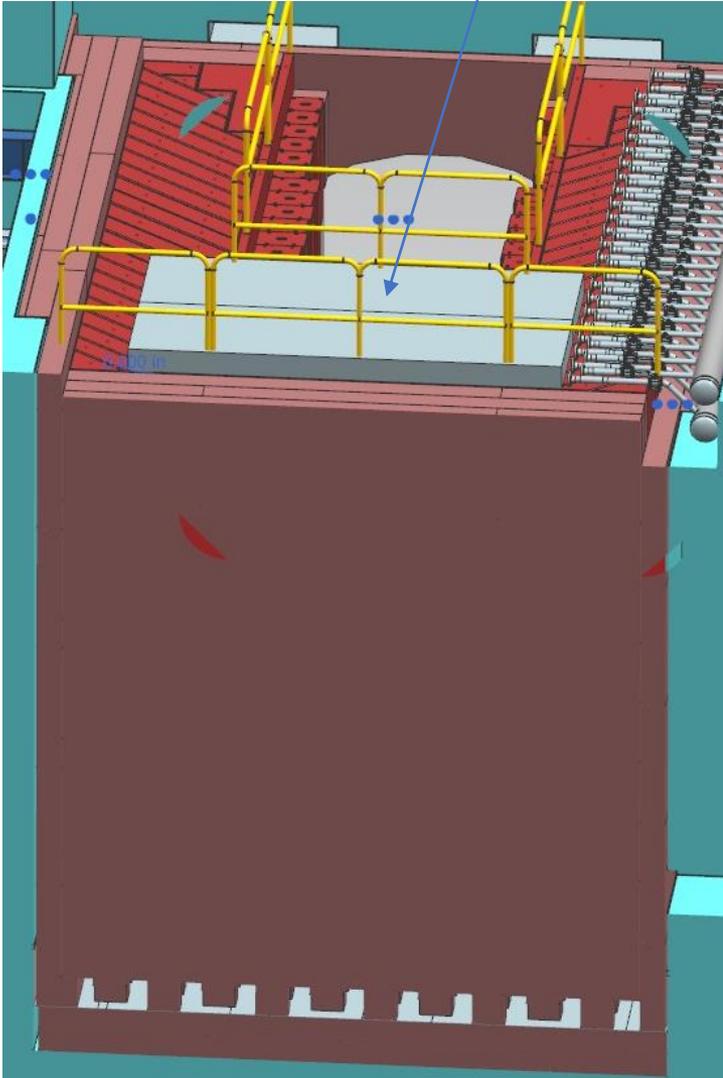
Four layers 213.25"x237.5" x 9.11" and two layers 232"x258.75" x 9.11" steel are installed in the downstream end of the absorber. Layers are welded from plates 48.75" width.



Downstream steel shielding installation

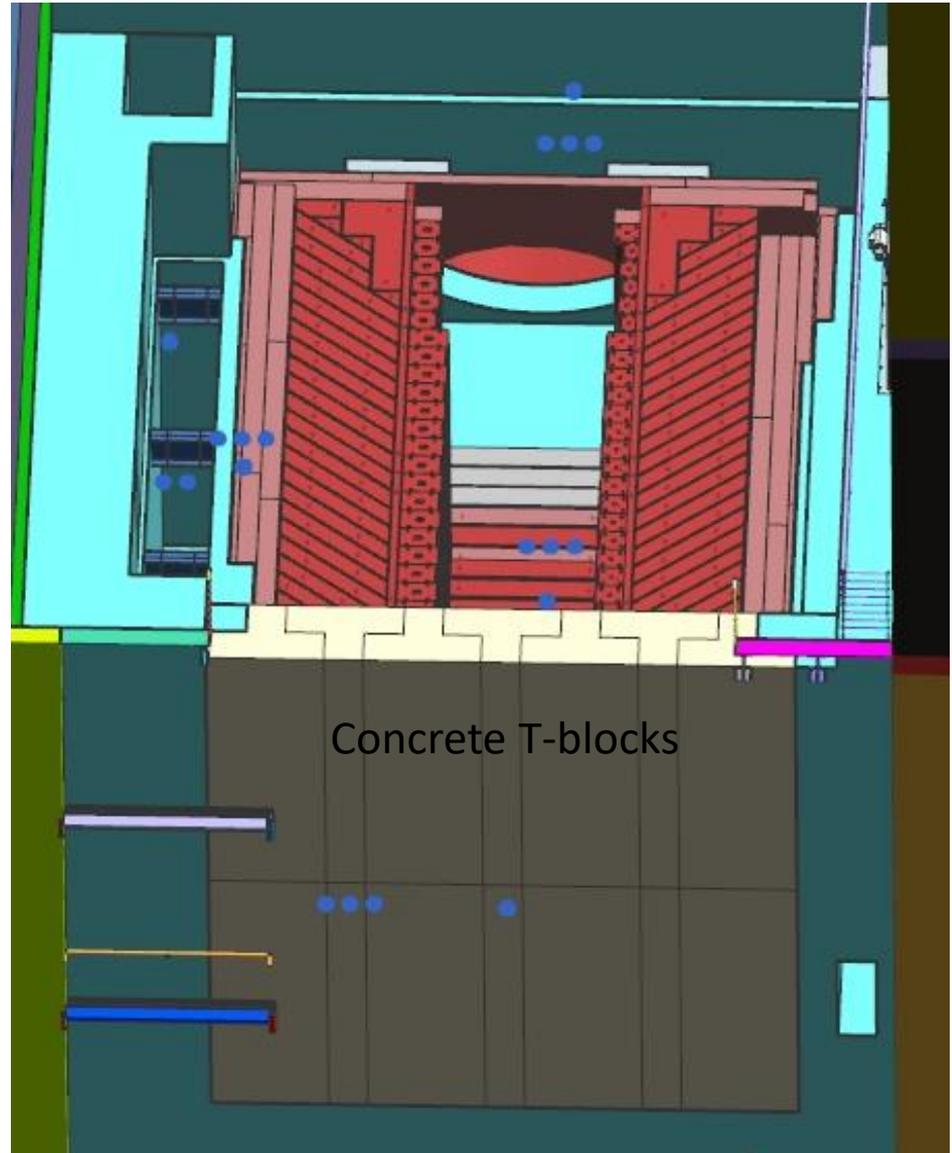
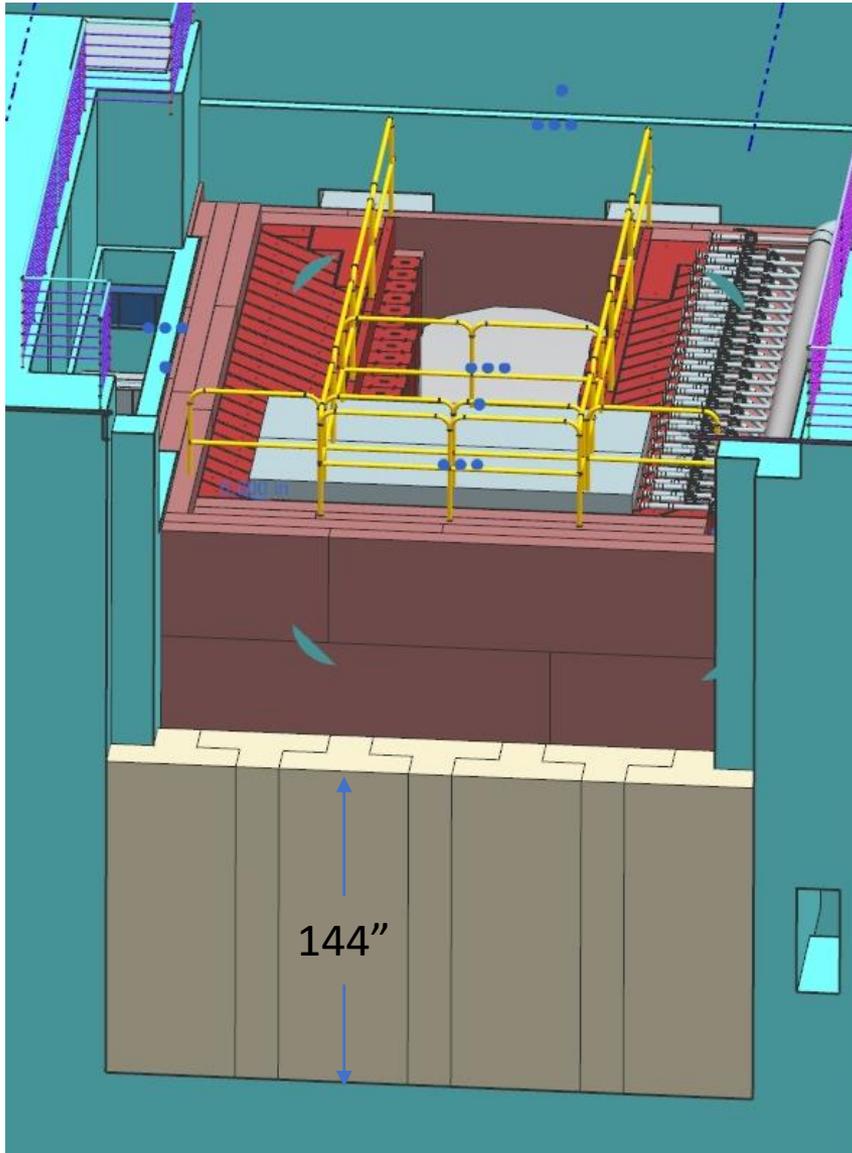
The temporary platform is installed before downstream shielding installation.

Temporary platform



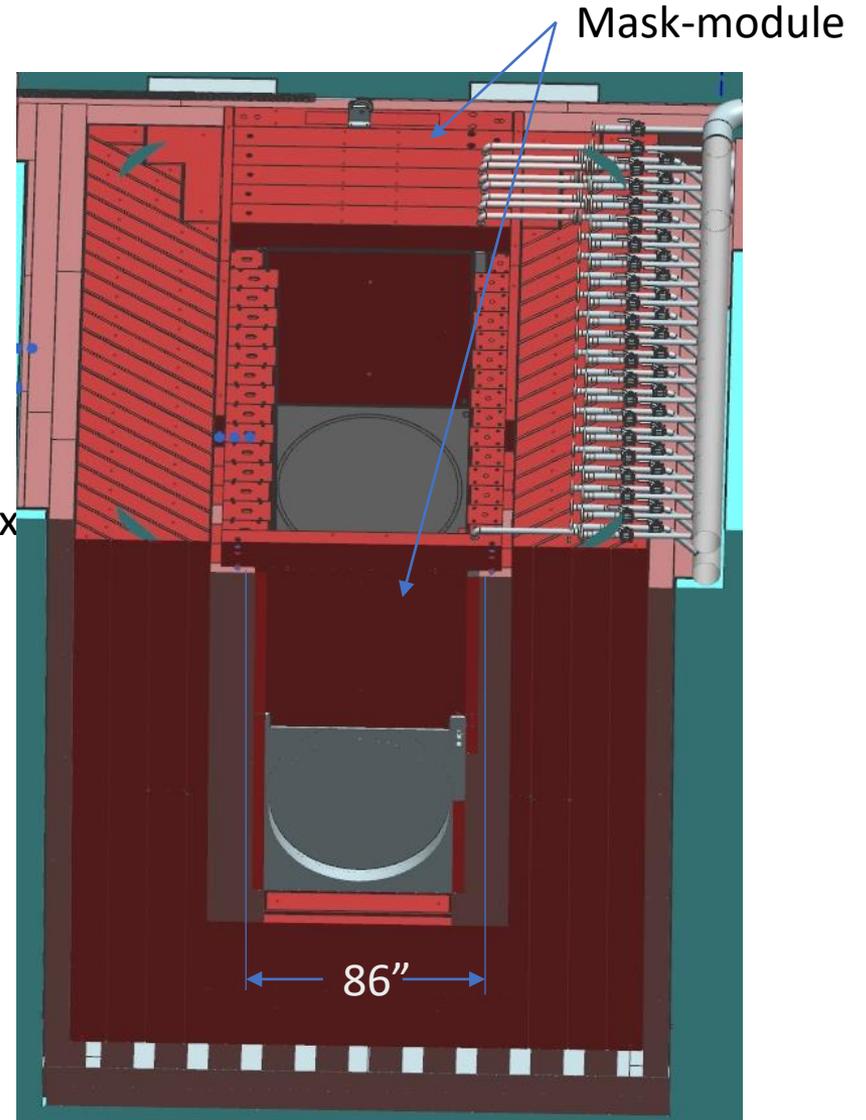
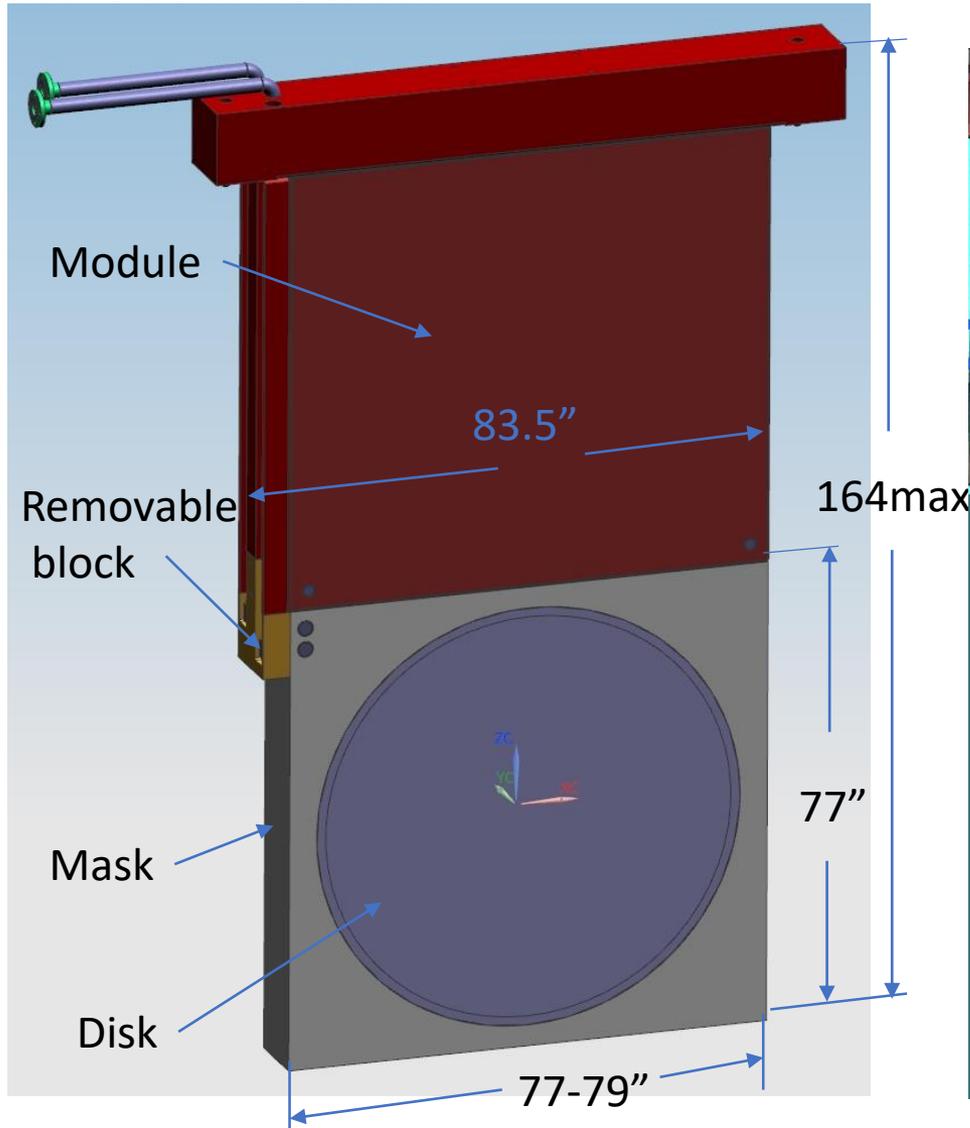
Concrete T-blocks installation

Fourteen concrete T- blocks are installed in the downstream end of the absorber.



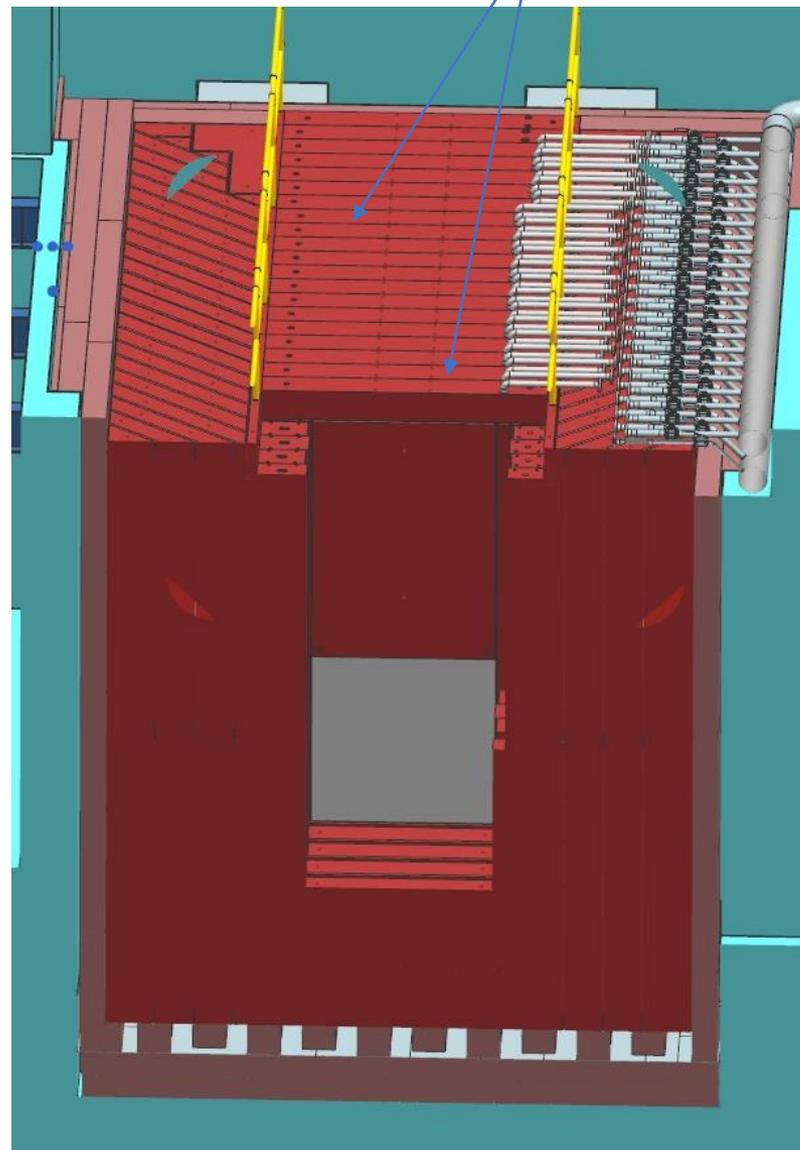
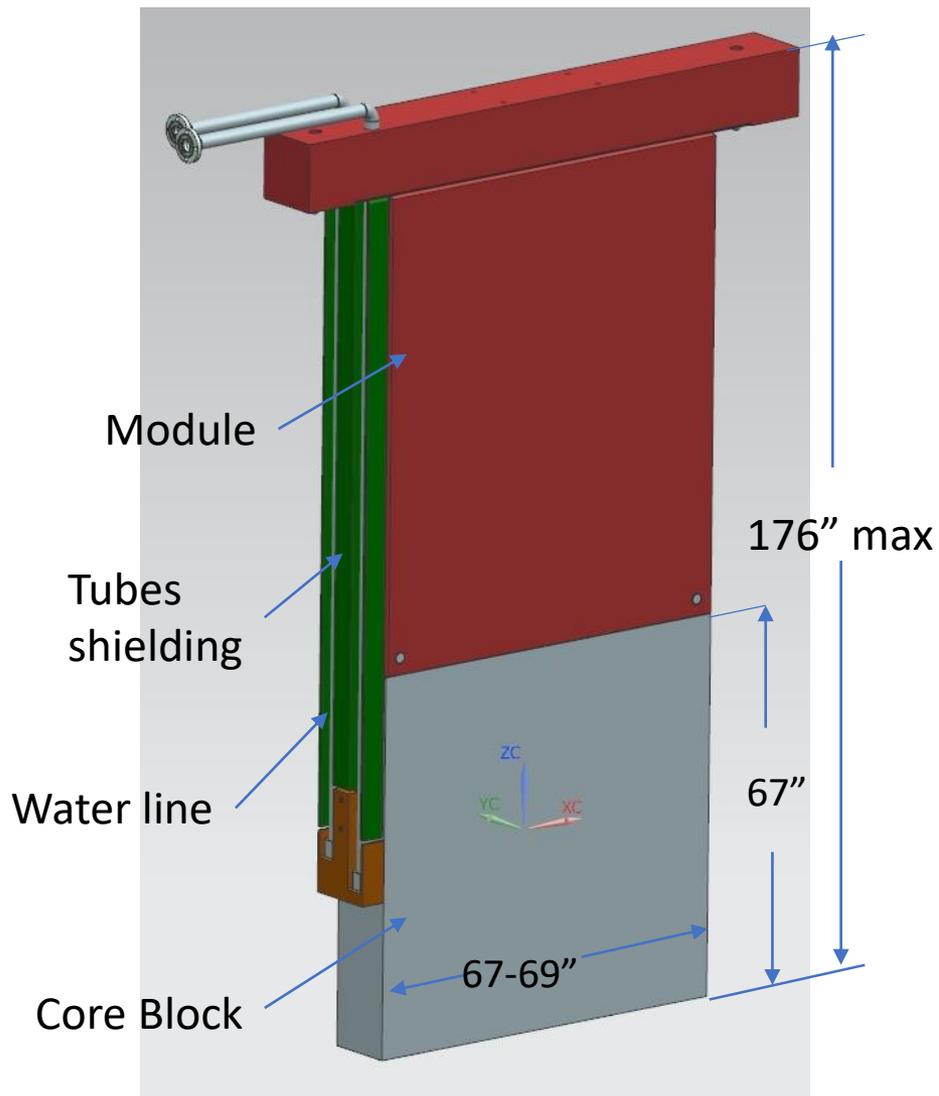
Absorber mask-module installation

For the mask-module delivery to the absorber one steel core block support structure cell has to be made wider.



Absorber Al core block –module installation

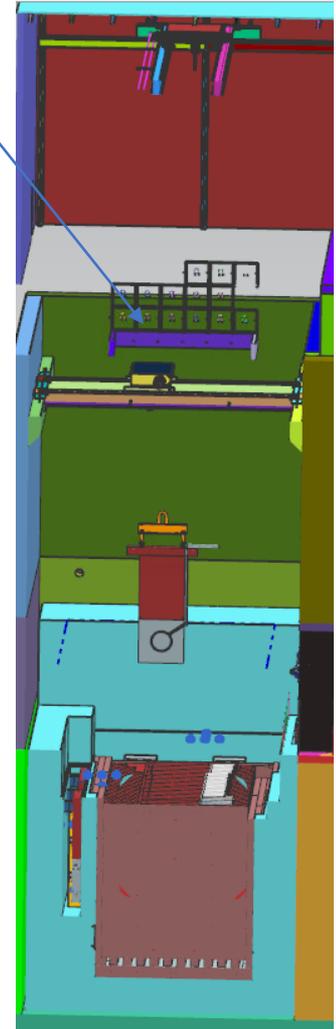
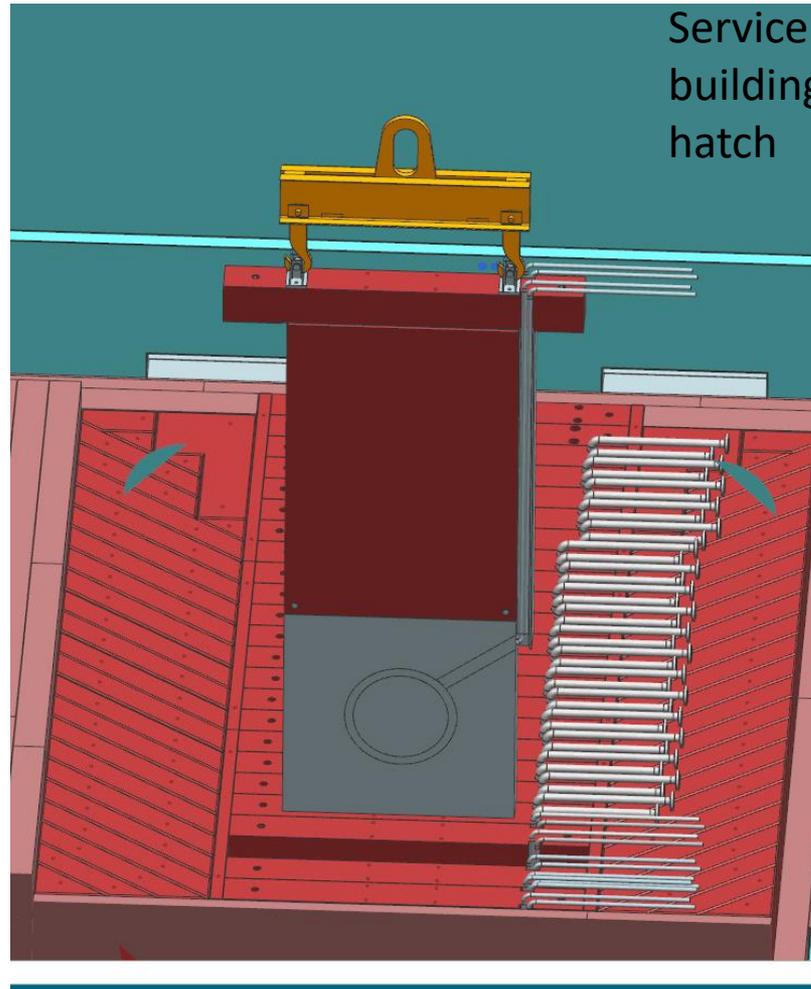
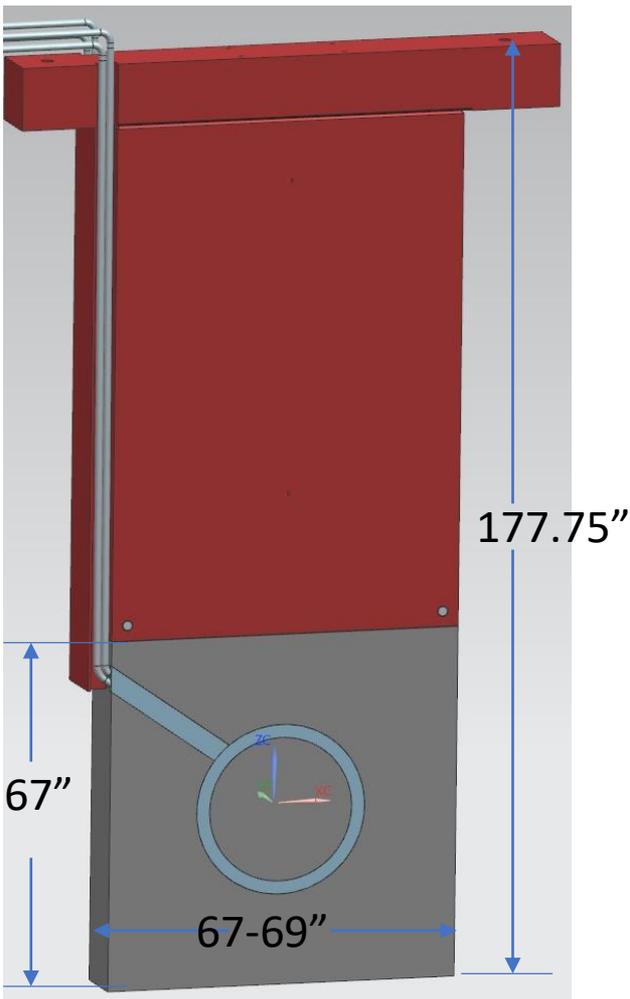
AL core block-module



Steel core block-module installation

All steel core block-module can be installed by service building crane.

Module



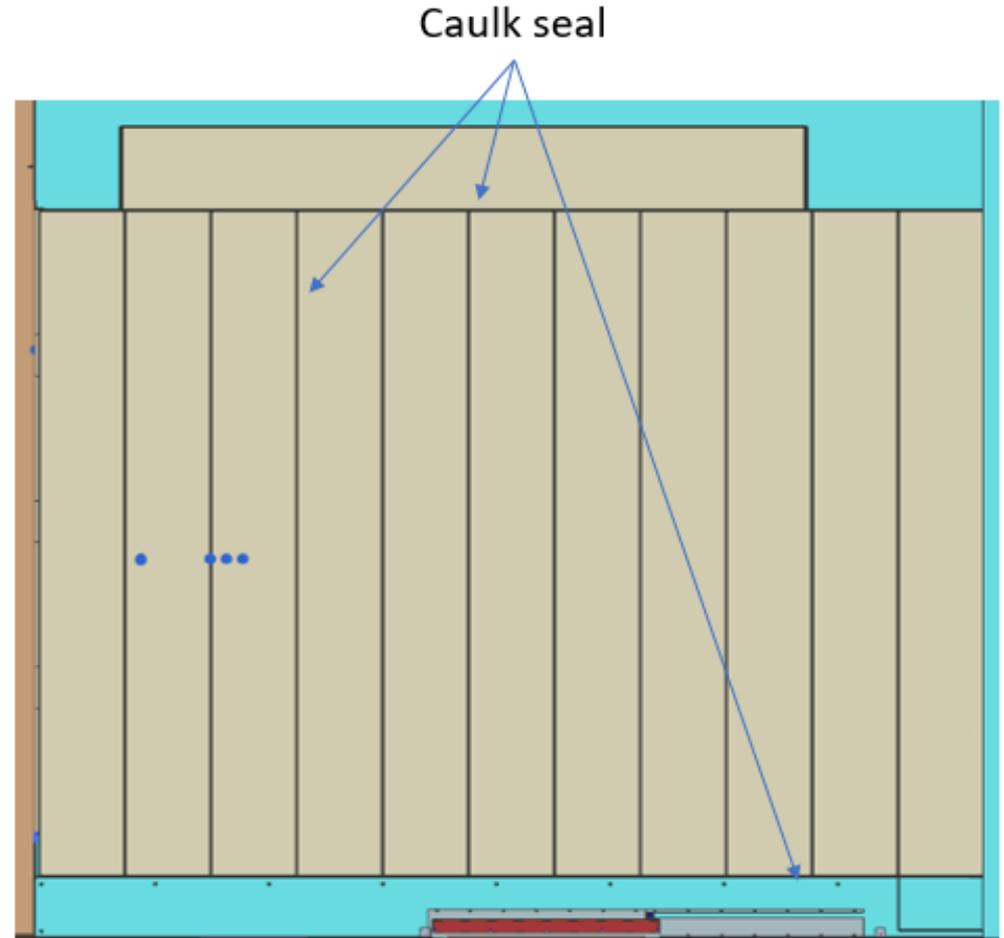
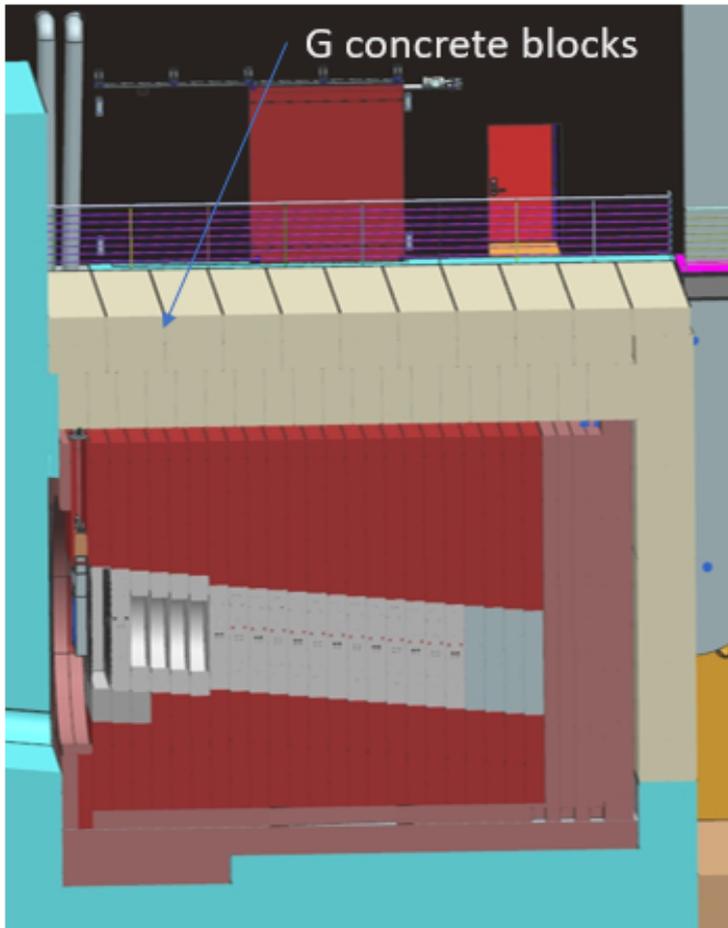
Water lines connection

After masks and core blocks modules installation core blocks and masks tubes are connected to the manifolds.



Top concrete blocks installation

Forty four G-concrete blocks (18"x36"x288") are installed in the absorber. Concrete blocks are delivered to the absorber hall by service building through the penetration. After installation all concrete blocks joints have to be sealed with the caulk.



Conclusions

1. The final design of the absorber is planned to be started when the Absorber Complex MARS calculations, the core blocks and steel shielding thermo and stress analyses, the absorber-decay pipe, the absorber-water cooling system , the absorber- air cooling system, the absorber –Hadron monitor interface will be completed.

2. The procurement plan and procurement specification is planned to be developed after the final design of the absorber completion.

3. The absorber installation procedure based on the final design and assembly scheme is planned to be developed with the Fermilab quality standards.

Back up slides

Water cooling manifolds installation

The water cooling supply and return manifolds are delivered to the absorber in several pieces and final weld can be done in the place.

